



IMPERIAL INSTITUTE
OF
AGRICULTURAL RESEARCH, PUSA.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.

INCLUDING
ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY.')

CONDUCTED BY
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VOL. I.—TENTH SERIES.

LONDON:
PRINTED AND PUBLISHED BY TAYLOR AND FRANCIS.
1928.

“Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini ex œconomiâ in conservatione, proportionè, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exulta; malè doctis et barbaris semper inimica fuit.”—LINNÆUS.

“Quel que soit le principe de la vie animale, il ne faut qu’ouvrir les yeux pour voir qu’elle est le chef-d’œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations”—BRUCKNER, *Théorie du Système Animal*, Leyden 1767.

. The sylvan powers
Obey our summons; from their deepest dells
The Dryads come, and throw their garlands
And odorous branches at our feet; the Nymphs
That press with nimble step the mountain-thyme
And purple heath-flower come not empty-handed,
But scatter round ten thousand forms minute
Of velvet moss or lichen, torn from rock
Or rifted oak or cavern deep: the Naiads too
Quit their loved native stream, from whose smooth face
They crop the lily, and each sedge and rush
That drinks the rippling tide: the frozen poles,
Where peril waits the bold adventurer’s tread,
The burning sands of Borneo and Cayenne,
All, all to us unlock their secret stores
And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



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THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[TENTH SERIES.]

"..... per litora spargite museum,
Natades, et circum vitreos considite fontes.
Pollice virgineo teneros hic carpito flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas
Ite, recurvato variata corallia trunco
Vellite muscosos e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo."
N. Parthenii Guannettasi, Ecl. 1.

No. 1. JANUARY 1928.

I.—*Oligochæta* from Lake Tanganyika (*Dr. C. Christy's Expedition*, 1926). By J. STEPHENSON, M.B., D.Sc., Lecturer in Zoology, Edinburgh University.

THE *Oligochæta* of Dr. Christy's recent expedition to Lake Tanganyika, a small though interesting collection, comprise four forms, two of these being new species (*Gordiodrilus paski*, *Ocnerodrilus (Ilyogenia) christyi*), one representing a new variety (*Stuhlmanni stappersi*, Mich., var. *kirandoensis*), while the fourth form, though belonging to a previously known species (*Alma emini*, Mich.), shows a combination of characters which justifies some words of description.

The records do not notably extend the range of the genera to which the several species belong.

I have to thank the authorities of the British Museum for the opportunity of examining these worms, from a locality from which so few *Oligochæta* have hitherto been recorded (for a list of previous records see Cunningham, 1920).

Family Megascolecidae.

Subfamily OCNERODRILINÆ.

Genus GORDIODRILUS, Bedd.

Gordiodrilus paski, sp. n.

586. (In the same tube with specimens of *Alma emini*) from mud in which grass and rushes were growing. Harbour, Kigoma. 23.ix.26. Two specimens, in a somewhat early stage of sexual maturity.

Of these two small worms, one was dissected and the anterior end of the other cut into longitudinal sections.

External Features.

The length of the worms was 37-42 mm., and their greatest diameter 1.25 mm.; one, which was somewhat damaged at the hinder end, showed 79 segments, the other 98. The specimens are unpigmented.

The prostomium is rounded, semicircular, and zygalobous.

Dorsal pores are absent.

The setae are closely paired; in the middle of the body *aa* is rather greater than *bc*, but in front of the clitellum these intervals are equal; *dd* is about half the circumference.

The limits of the clitellum are rather indistinct anteriorly; the clitellum is ring-shaped, and includes segments $\frac{1}{2}$ xiii. or xiv.-xviii. and a small part of xix.

The prostatic pores are two pairs, and are situated on segments xvii. and xviii.; they are in the immediate neighbourhood of the ventral setae; setae *a* are present on both sides of xvii. and on one side at least of xviii., but seta *b* is absent in both segments. The seminal grooves connecting the apertures of the same side are straight. The grooves and pores are included in a male genital field of whitish colour, slightly raised, and oval in shape with the long axis longitudinal in direction. Neither the male nor the female pores could be distinguished; but in sections the vasa deferentia are seen to end in furrow 17/18.

The spermathecal pores are inconspicuous, and open in line with setae *b* in furrows 7/8 and 8/9.

Internal Anatomy.

In the dissection no septa appeared to be notably strengthened, but in sections septa 5/6-8/9 were seen to be somewhat thickened.

In segment ix. the oesophagus is swollen, soft-walled, and vascular; and attached ventrally by a narrow neck is a single saccular appendage, of relatively large size (as large as the oesophagus itself in segment ix.), rather flattened dorso-ventrally, with a large blood-vessel leading off from its anterior end.

There is no gizzard. The intestine swells out in segment xii.

The last hearts are in xi.

The nephridia begin in segment xii.; the first pair are small; each nephridium is largely covered by opaque, very granular cells, many of which contain large vacuoles. From the dissection the nephridiopores appear to be in line with setae *d*.

In the dissection the testes could not be identified, and small seminal funnels were seen in segment xi. only. But the dissection of such a small worm is difficult, and the specimen was not fully mature. The results of sectioning are therefore more trustworthy; the sectioned specimen shows testes and funnels in both x. and xi. There are no testis-sacs.

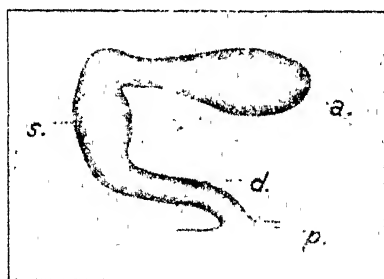
Small seminal vesicles are present in segment xii. only; they have a scalloped or lobulated margin.

The prostates are two pairs; each is a relatively very long, thin tube, coiled in large loose coils, the ectal portion rather slenderer still, but not shiny, so that there is no sharp distinction to be seen between glandular part and duct. Microscopically the glandular cells give place to a low lining epithelium, and a strong muscular investment makes its appearance, only a very short distance—a distance about equal to half the diameter of the worm—from the entry of the duct into the body-wall.

The setae in the immediate neighbourhood of the prostatic pores are of the ordinary shape, and there are no penial setae.

The spermathecae are small (fig. 1); the ampulla is ovoid, with a length of 0.23 mm. and a diameter of 0.1 mm., its long axis horizontal and parallel to that of the body. This is continued posteriorly into a duct, with a diameter of 0.07 mm. at first, soon, however, becoming thicker, —0.1 mm., equal to the diameter of the ampulla; this swollen part of the duct bends towards the

Fig. 1.



Gordiodrillus paski: a spermatheca. a., ampulla; d., duct; p., parietes; s., swelling on duct.

body-wall. The duct now curves still further, taking a forward direction and resuming its former diameter; lastly, it turns at right angles again, piercing the body-wall.

In the swollen part of the duct there are, contained within the duct-wall, a number of small diverticula, each very shortly tubular, lined by an approximately cubical epithelium, and communicating with the lumen of the duct. The whole is surrounded (as is the rest of the duct) by muscular fibres and peritoneum, the latter not, I think, glandular. One spermatheca in the sectioned specimen appears to have four diverticula, the other of the same side about eight; on the other side the numbers appear to be five and five. The length of the duct, exclusive of the portion which is contained within the body-wall, is greater than that of the ampulla; on the side in which it is cut so as to be more easily estimated it seems to be nearly twice as long.

Remarks.

The present form appears to be quite distinct from any species of the genus previously described. In *G. zanzibaricus* the setae are all decidedly ventral in position; the nephridia begin in segment v.; and there are ovisacs in xiv.; the spermathecae are inadequately known, but it is stated (Beddard, 1895) that they have a short muscular duct. In *G. habessinus* the setal ratios differ, *aa* being less than *bc*; the spermathecae have quite a different form, and a smaller number of diverticula in the wall of the duct; this species would, however, seem to be the nearest relation of that here described. *G. papillatus*, from Lagos, and *G. madagascariensis* are too distinct to require comparison, and the same may be said of other forms.

Genus OCNERODRILUS, Eisen.

Ocnerodrilus (Ilyogenia) christyi, sp. n.

- 411 F. From sand under stones on and below water-line, rocky shore. Kirando. 18.x.26. Numerous specimens, many sexually mature.
 435 S. In sand and under stones, water-line and below, rocky shore. Kirando. 16.x.26. Numerous specimens, mostly sexual, in very bad preservation, much softened.
 449 F. Under stones, muddy shore. Kapili. 28.x.26. Seven specimens, none showing any sign of sexual maturity (the identification with the above is therefore not quite certain).

External Features.

The length of an average and moderately well-preserved specimen is about 25 mm., the maximum 30 mm.; but some of the softened specimens will easily stretch out to 55 mm. The average diameter is about 1 mm., the maximum 1.25 mm., or possibly up to 1.5 mm. at the clitellum. The worms are in general non-pigmented, but the clitellum is markedly reddish. The number of segments varies from 96 to 114. In a large number of worms the anterior portion has separated off in or just behind the clitellum.

The prostomium is zygotobous.

There are no dorsal pores.

The setae are closely paired; behind the clitellum $aa=3ab=3cd$, and is slightly less than *bc*, which in turn is slightly less than *dd*; *dd* is equal to about one-third of the circumference, or less in the hinder part of the body. The setae are of relatively large size; in length they average 0.25 mm.; the nodulus is about a quarter of the length from the tip; they are single-pointed, and show no ornamentation.

The situation of the clitellum and of the genital pores varies; out of twelve specimens examined, in three the clitellum extends over segments xiv.-xviii., the male pores are on xvii., and the spermathecal pores in 8/9; in three the clitellum extends over

xv.-xix. (perhaps in one case including $\frac{1}{2}$ xiv. also), the male pores are on xviii., the spermathecal pores in 9/10; in six the clitellum includes xvi.-xx. (perhaps in one specimen $\frac{1}{2}$ xv. also), the male pores are on xix., and the spermathecal pores in 10/11 (in one of these there was a slight irregularity, the spermathecal pore of the left side being in 10/11, that of the right in 9/10). From the sectioned specimens it is seen that the positions of the testes and ovaries correspond—the testes and male funnels being in xi. and xii. and the ovaries in xiv., where the male pores are on segment xviii., and one segment further back still where the male pores are on xix.

From the position of the gonads, as well as from a comparison with other species of the subgenus, it is evident that the variations are due to the intercalation of one or two extra segments in front of the spermathecal region. This intercalation is occasionally accompanied by an irregularity of setal distribution; thus in a specimen where the male pores were on xix. segment ii. had only one pair of ventral and one pair of lateral setæ.

The clitellum is somewhat swollen, reddish in colour, and rather indefinite in extent, especially at its anterior end; it is absent in the mid-ventral line. The male pores (practically confluent with the prostatic pores) are inconspicuous on external examination; they are close to the ventral setæ of the segment on which they occur—I think immediately external to *b*,—setæ and pores being situated in a small whitish transverse extension of the median unpigmented strip between the ventral margins of the clitellum. The setæ (*a* and *b*) appear to be somewhat enlarged (to external examination).

The spermathecal apertures are one pair, situated in line with the ventral setæ, more particularly, I think (from internal dissection), in the line of *b*. The segments which bound the pore are, rather characteristically, slightly swollen, the height of the swelling being the dividing-line between the segments; there is thus no furrow in this situation, but rather a low ridge, and the apertures are situated on the crest of this ridge.

Internal Anatomy.

Unless otherwise stated, the organs are supposed, in the following description, to have the normal position—testes and funnels in segments x. and xi., male pores on xvii., etc.

Septa 5/6-8/9 are somewhat strengthened.

There is no gizzard; the masses of chromophil cells (pharyngeal glands) extend back to segment viii. The alimentary tube is almost squeezed out of existence in segment ix. by the spermathecæ, and in the testis-segments by the mass of developing male cells, and becomes a mere canalized thread, which is at its narrowest only 55 to 70 μ in diameter. The œsophageal diverticula arise separately from the lateral walls of the tube at the hinder limit of segment ix., and extend forwards as narrow tubes parallel to

and by the side of the œsophagus through the greater part or whole of the segment. The diverticula may be slightly wider at their anterior blind ends; they are ridged internally, the ridges being irregular, and possibly coalescing towards the anterior end of the diverticulum so as to produce a number of tubules; but the histological condition of the material is scarcely good enough to allow a positive statement on this point. The diverticula, like the œsophagus, may be much compressed by the genital products—by the seminal vesicles of segment ix., and by pressure exercised through the septa by the large mass of developing male cells; in one series of sections the diverticulum of the right side is barely recognizable.

The testes and funnels are free in segments x. and xi.; septa 10/11 and 11/12 are much bulged back, in fully mature individuals, by the masses of sperm-morulae and developing spermatozoa which fill the segments. One pair of seminal vesicles, the smaller, are present in segment ix., and another pair depend backwards from septum 11/12; the posterior pair extend far back, into the clitellar region, to the level of segment xvi. or even almost as far as the male pores. The mass of genital products in segments x. and xi., and the bulging back of the septa which these occasion, almost squeeze segment xii. out of existence, and the connection of the posterior seminal vesicles with septum 11/12 and the cavity of segment xi. takes place by a narrow neck.

The prostates are a single pair of winding and twisted tubes; in one specimen the gland was seen to extend back to segment xxviii. on one side, but on the other side it was more twisted and did not reach so far. The glandular part ceases, and the tube becomes the duct, only a very short distance before it enters the body-wall. The vas deferens has an undulating course on the body-wall; the last part is thicker, and is easily seen in dissection; it meets the prostatic duct where they both enter the body-wall, but remains distinct as it passes through the parietes, and the two tubes open on the surface (as shown in sections) in the closest possible proximity.

The ovaries and female funnels are situated in segment xiii.

The spermathecae are a single pair in segment ix.; each is a considerable sac, of irregular shape, and when fully developed of some size; thus it may push its way back to the level of segment xii. The ampulla has a thin wall, with a glandular epithelium which is very heavily vacuolated. The duct is short, and extremely narrow relatively to the size of the ampulla; it is distinctly marked off (not merging into the ampulla by a gradual widening). There is no diverticulum.

The spermathecae are subject to considerable variation. They may be of different sizes on the two sides; or both may be quite small, the bulk of segment ix. being taken up by the seminal vesicles. In one of the dissected specimens there was a large spermatheca on one side filled with a glancing mass of sper-

matozoa, while none was present (or at least visible) on the other side; in another, no spermathecae were visible at all.

In one of the sectioned specimens several irregularities were found. The organs were in general shifted two segments backwards, so that the testes and funnels were in xii. and xiii., the ovaries and ovarian funnels in xv. In segment xi., on the left side, there were a few fair-sized ova and a folded ovarian funnel, with a rudimentary gonad whose nature could not be determined from examination of its structure; on the right side there was present a male funnel on which there were some spermatozoa, and a gonad, apparently a testis. Neither funnel was continued into a duct. The spermatheca of the left side, in segment xi., opened between segments x. and xi.; that of the right, in x., between ix. and x.; there was no spermatheca on the right side in segment xi. On the left side in segment x., however, there was a duct, opening in 9/10 and resembling exactly a spermathecal duct; this was continued at its ental end into an irregular thin-walled sac, the epithelium of which was disintegrating and mostly lying loose in the cavity, but in any case was not of the vacuolated glandular kind seen in the normal spermathecae; this sac extended back through septum 10/11 by a narrow neck and expanded again in xi., into an elongated bag of some size, though rather narrow, lying close alongside the œsophagus.

There are no penial setæ.

Remarks.

A species of this subgenus (*O. (I.) cunningtoni*) has already been recorded from Lake Tanganyika by Beddard (1906). The present species, however, differs from that in having single-pointed setæ (they are bifid at the tip in *O. (I.) cunningtoni*); in having paired œsophageal diverticula arising posteriorly in segment ix. and extending forwards (in Beddard's species there is a small single but bifurcated pouch which arises anteriorly in ix. and extends backwards); in having the ovaries free (in *O. (I.) cunningtoni* they are surrounded by a tubular sheath which opens behind into segment xiv.); finally, there is no hint in Beddard's description of the variability in position of the sexual organs which is so characteristic of the present species.

Of the other African species the only one which need be compared with the present form appears to be *O. (I.) jeanneli*, described by Michaelsen (1914) from 4000 m. alt. on Mt. Kenya: in this the prostomium is epilobous 5/6; $dd=1/9-2/3$ of the circumference; the setæ are ornamented; and the chyle-sacs (œsophageal diverticula) are stoutly pear-shaped and ridged internally by twelve fairly deep folds.

Family Eudrilidæ.

Genus STUHLMANNIA, Mich.

Stuhlmannia stappersi, Mich., var. *kirandoensis*, nov.

- 594 F. From sand in bed of blocked river-mouth, Kirando. Numerous specimens, many sexually mature.
613. Same locality. Numerous specimens, in very bad condition.
614. Same locality. Numerous specimens, the majority not sexually mature.
- 412 F. From bottom of silted river-mouth which had partially dried during the dry season; the worms were, however, on and below the water-line. Kirando. 20.x.26. A number of specimens, none quite mature.
- 453 F. From sand; Kapili Bay. 3.xi.26. A number of specimens, several showing signs of sexual maturity; several in fragments.

External Features.

The length of good-sized examples is from 125 to 150 mm.; the longest was 170 mm. The worms are thin in proportion to their length, especially in their hinder half; the maximum diameter (at the clitellum) is 3 mm., behind the clitellum they are about 2 mm., and in the hinder half 1.5 mm. One specimen which was only 47 mm. long was nevertheless fully sexual.

In a specimen 120 mm. long I counted 195 segments.

The colour is brown, with a purplish tinge, which is often more marked over the clitellum.

The prostomium is short, but fairly broad at the base, rounded in front, epilobous $\frac{1}{2}$; the grooves which bound the tongue laterally are faint. There is no secondary annulation.

Dorsal pores are absent.

The setæ are small and very closely paired, and all are ventral; $aa=bc$, and dd =two-thirds of the circumference.

The clitellum extends over $xiv.-\frac{1}{2}xvii.$ ($=3\frac{1}{2}$); it is less marked along the mid-ventral line. It is smooth and swollen; its extremities are not sharply limited; setæ may or may not be visible on it.

The male pore is single, on segment $xvii.$, on a large conical median papilla which takes up the whole length of the segment and extends on each side to midway between the lines of setæ b and c ; the base of the papilla is circular, and is well defined by a narrow groove in front and behind, though not at the sides. The aperture is large, and is situated slightly on the anterior side of the summit of the cone. In fully sexual specimens two large penial setæ are often seen projecting; these cross at their base, that coming out from the right side pointing obliquely forwards to the left, and *vice versa*.

The spermathecal pore is situated in the centre of a large flat-topped oval papilla, the long axis of which is longitudinal. The papilla is situated principally in segment $xiii.$, and extends from furrow 12/13 nearly to the setal zone of $xiv.$; the slight annular

ridge marking the setal zone of xiii. bends forwards and passes over the anterior part of the papilla, so that the aperture is some distance behind this ridge. Transversely the papilla extends outwards beyond the line of setae *b*; its longitudinal extent is a quarter or a third greater than its breadth. The papilla is well defined, especially in front and behind, by a narrow groove.

There are no other genital markings.

Internal Anatomy.

Septa 5/6-8/9 are considerably strengthened, 9/10-10/11 somewhat so, 11/12 only slightly; the rest are thin.

There is a small cylindrical gizzard in segment v.; though small, it is quite definite and firm. In vi. the alimentary canal is extremely vascular, with mid-dorsal and transverse blood-channels visible in the wall; and from vi. to ix. there are on each side of the oesophagus the twisted vascular coils clothed with more or less of the characteristic fatty substance of the "fatbody-like organs." In addition, on the posterior walls of segments viii., ix., and x. are paired whitish folded lamellae, which, at first sight, resembled rudimentary seminal vesicles; on microscopic examination they were found to consist of a tissue which was full of minute refractile granules, the whole opaque and hence dark by transmitted light.

The intestine begins in xv.

The last hearts are in xi.; those in x. and xi. are very large.

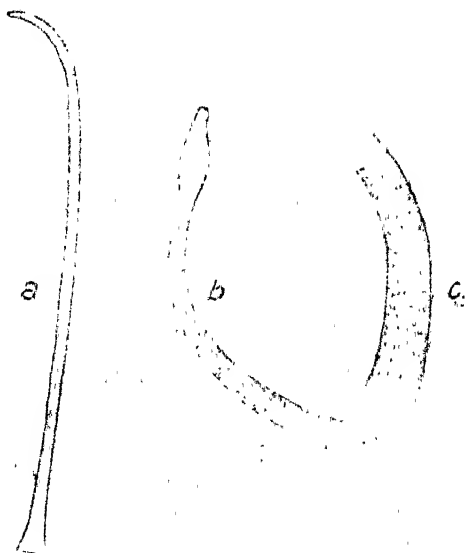
Testes and funnels are free in x. and xi. (testes not identified in xi.). The seminal vesicles are two pairs in xi. and xii., of moderate size, finely lobulated so as to appear granular on the surface; those in xii. are the larger. The vasa deferentia of each side run backwards, close together, to segment xvii.; they end by uniting and immediately thereafter joining the prostate of the same side just before the two prostates meet and unite in the middle line.

The prostates (euprostates) are cylindrical and relatively rather narrow tubes, with a somewhat curling course and a smooth shining surface with "muscular" glitter; they extend back to segments xxvii. and xxviii. on the two sides respectively (in the specimen in which they were more particularly examined), and unite in front, underneath the ventral vessel and ventral nerve-cord, to form a short tube, its diameter about equal to that of either component separately, which immediately enters the body-wall. There is no dilatation or muscular bursa. The penial setal sacs are situated laterally to and in front of the termination of the prostatic apparatus, diverging obliquely backwards; they are accompanied by numerous long and conspicuous muscular strands. There is a single seta on each side.

A penial seta (fig. 2) is 3.2 mm. in length and 60μ thick in the middle; the extreme basal end thickens rather rapidly, like the base of a cone. The greater portion of the shaft is almost straight, while the distal end curves through the quadrant of a circle, gradually tapering and ending in a blunt point. The distal

end has not always quite the same shape: it may show a groove on the outer side of the curve, or it may be not grooved but somewhat flattened or expanded; but the flattening does not, so far as I have seen, extend down the shaft as far as in the typical form of the species. The ornamentation consists of a number of fine scars, irregularly scattered in somewhat indefinite transverse lines, over the curved portion of the seta; sometimes two or three of the markings are joined together so as to form an irregularly notched ridge. The extent of the markings along the shaft varies somewhat.

Fig. 2.



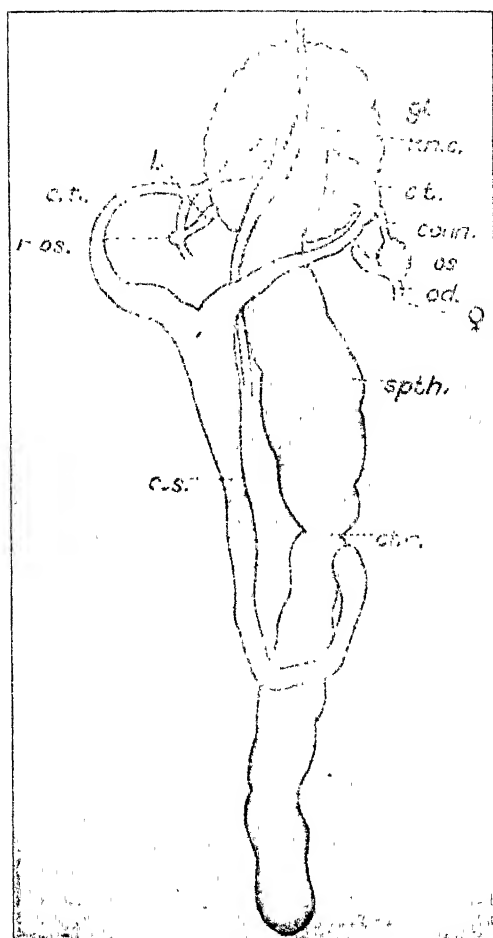
Stuhlmannia stappersi, var. *kirandoensis*: penial setæ.

a, general form, $\times 23$; *b*, distal end of seta with expanded tip, \times ca. 100;
c, to show details of ornamentation on distal part of shaft, \times ca. 250.

The spermathecal pore leads into the spermathecal ampulla (fig. 3, *sptl.*); a separate atrium is not distinguishable. The ampulla is an elongated sac; the first portion of its wall is very firm, but there is a gradual diminution in firmness towards the ental end, where the wall is softer and thinner; the outline of the ampulla is irregularly swollen throughout its length, the anterior half is broader than the posterior, and in the specimen figured there was a distinct constriction (*ctr.*) between the two portions. The ectal end of the spermathecal apparatus is surrounded by a cushion-like glandular-looking mass (*gl.*), with a

sharply-defined margin which can be lifted up by a needle from the underlying body-wall; this margin is rather regularly lobulated or crenated. The whole spermatheca extends back as far as segment xviii.

Fig. 3.



Stuhlmannia stappersi, var. *kirandoensis*. Female organs, as seen in dissection: *conn.*, connecting tube; *c.s.*, coelomic sac; *c.t.*, coelomic tube; *ctr.*, constriction of spermatheca; *gl.*, glandular mass round base of spermatheca; *l.*, loop of oviduct; *od.*, oviduct; *os.*, ovisac; *r.os.*, rudimentary ovisac; *spth.*, spermathecal ampulla; *v.n.c.*, ventral nerve-cord; ♀, female pore.

The membranous investment of the base of the spermatheca is continued on each side into a "coelomic tube" (*c.t.*); the tubes of the two sides ascend round the gut, and unite dorsally; before their union they increase somewhat in diameter. From their junction is prolonged backwards a "coelomic sac" (*c.s.*)—a thin-walled white tube lying on the gut, broader in its anterior part, narrower behind, the hinder end (in the example selected for illustration, fig. 3) bent forwards; if the sac had been straight instead of bent it would be nearly as long as the spermatheca. In a second dissected specimen the coelomic sac was shorter; and in a specimen which was sectioned it was shorter still.

The oviducts (*od.*) end on the body-wall in line with the lateral setæ; they are short narrow tubes, the one on the right side bearing, close to its junction with the parietes, a round mulberry-like egg-sac (*os.*), which is scarcely represented on the left side (*r.os.*). This asymmetry was found in both the dissected and sectioned specimens, and is therefore presumably constant in this form. At the level of the egg-sac the oviduct is thrown into a short loop (*l.*), the two limbs of which are bound together, so that the structure of the finger-like projection so formed is not evident without microscopic examination. Entirely the oviduct is continued as a "connecting tube" (*conn.*) to join the coelomic tube near its origin at the base of the spermathecal sac.

The above is all that can be seen in dissection; neither ovaries, ovarian chambers, nor sperm-receptacles are to be distinguished. The examination of sections, however, gives additional information.

The ovisac consists of a spongy stroma, containing a number of small loculi: in some of the loculi are contained clusters, one in each loculus, of small deeply staining cells; in others, an ovum, also one to a loculus—presumably one cell of each cluster becomes an ovum, the rest being used as food. The ovisac is therefore ovary also, and a special ovarian chamber is wanting.

There is no definite tubular communication between the ovisac and oviduct; the connection of the two structures is by means of a stout stalk, without lumen, though composed of a fairly loose connective tissue. How the ova make their way out is therefore not obvious.

Sections reveal no sperm receptacle; but in one of the dissected specimens the ventralmost portion of the "coelomic tube" on the right side (near its origin, and below the junction of the "connecting tube") was filled with a loose opaque white matter which on microscopic examination was found to be a mass of coelomic corpuscles mixed with spermatozoa.

The ovarian funnel is represented only by the epithelial lining of the connecting tube. This is high, but somewhat irregular in height, folded and ciliated; as one follows the tube downwards towards the surface, the epithelium becomes more regular, so that in the projecting loop of the oviduct the lumen is perfectly circular and the lining cells, still ciliated, form a layer of absolutely even height.

The microscopic appearances of the glandular mass which is disposed in a circle round the base of the spermatheca have puzzled me. The mass consists of a stroma packed with (apparently) abortive ova and wisps of abortive spermatozoa, the spermatozoa on the whole rather in the more superficial parts, the ova on the whole lying more deeply. This tissue extends for some distance backwards on the surface of the spermatheca—in what would be the region of the “atrium” in the type-form of the species.

These spermatozoa must have been produced *in situ*, since the spermathecal aperture is not patent—and this in spite of the fact that in both of the sectioned specimens the clitellum was well developed, and the spermathecal and male papillæ fully formed. In one specimen, indeed, there is a narrow cleft leading from the cavity of the spermatheca to the surface; but this cleft has no epithelial lining and looks like a tearing of the tissue, and the cuticle still stretches across the mouth of the break. In the other specimen the spermathecal cavity approaches a depression of the surface, but the tissue is unbroken. There are also other peculiarities, the consideration of which, however, must for the present be deferred.

Remarks.

The type-form of the species was described by Michaelsen (1915) from the Belgian Congo, one of the localities being the plain of Uvira at the north end of Lake Tanganyika and the other being near its western shore. The present variety is from Kirando, on the eastern shore near the south end of the lake.

The essential difference between the present variety and the type consists in the asymmetry of the female organs (egg-sac vestigial on the left side) in the variety. There are a few other differences between the two in the topography of the female organs, *e.g.*, the projecting loop of the oviduct on each side in the variety here described appears to be absent in the type-form; and the present specimens are pigmented, whereas Michaelsen's were of a light flesh-colour, without pigment.

Family Glossoscolecidae.

Subfamily MICROCHÆTINÆ.

Genus ALMA, Grube.

Alma emini, Mich.

586. From mud in which grass and rushes were growing; Harbour, Kigoma. 23.ix.26. A number of specimens, four of which were sexually mature.

External Features.

None of the mature specimens were complete posteriorly, but one, which had probably not lost more than an inch from its hinder end, was 240 mm. in length and had 340 segments.

Another specimen, however, must have originally been considerably more than 240 mm. in length. An immature specimen, complete at its hinder end, measured 205 mm. The maximum diameter of the worms was 4 mm.

The body is quadrilateral behind the region of the copulatory appendages, and in the posterior region shows a dorsal groove; the setæ are at the corners. The hinder end becomes flattened dorso-ventrally, with two sharp lateral edges; these traced forwards become the dorso-lateral angles of the quadrilateral body. The anus is dorsal, of an elongated triangular shape, the base of the triangle being posterior.

The colour is greyish, with a greenish tinge in places; the clitellum is reddish.

The prostomium is large, triangular with rounded tip, and zygalobous.

The anterior segments show a secondary annulation, with 3, 4, 5, or 6 annuli to a segment.

The setæ are large, are moderately closely paired, and begin in segment ii. Behind the copulatory appendages $aa=2\frac{1}{2}ab$, and dd is slightly greater than aa , in the middle of the body $aa=3-3\frac{1}{2}ab$, and dd is about equal to or slightly greater than aa ; towards the hinder end $aa=3-3\frac{1}{2}ab$, and dd is very slightly greater than aa . The setæ are ornamented near the tip by about a dozen interrupted circles of fine points.

The copulatory appendages are attached to segments xviii.-xx., in line with setæ *a*, the site of attachment including the whole of xix., one-third of xviii., and about half of xx.; setæ *b* are present on all three segments external to the attachment of the appendages. The length of the appendages is 25-30 mm.—as long as the part of the body in front of them; the distal two-fifths of each organ is flattened, expanded, and concave on its median face, the rest of the organ being cylindrical, or in one specimen flattened and grooved on its median aspect, so as to form a groove which is continuous with the concavity of the expanded distal portion. The expanded portion is 3.5 mm. in width, the base 1.25 mm. The whole organ is transversely ringed, as if segmented; the concavity of the distal portion is also marked by longitudinal grooves.

The small sucker-like depressions which are features of the appendages, each with a copulatory seta in the middle, form a series of a dozen or more round the end of the expanded portion of the organ on the concave side; the series extends further along the anterior than the posterior margin. In addition, there is a separate series, more proximally situated, either near the anterior border of the expanded portion or near the posterior border and extending on to the beginning of the stalk.

On the median face of the stalk are a few small round papillæ, each with a copulatory seta; these papillæ are most often two in number, but are sometimes absent; in one specimen, however, they were more numerous—nine and five respectively on the two sides.

The setæ are lancet-shaped, the distal end being flattened, rhomboidal in shape, and pointed (fig. 4).

The male pores are not evident, but in an appendage cleared, flattened, and mounted in balsam, the pore appears to be on the median face of the organ at half its length, and thus on the stalk, not on the expanded portion.

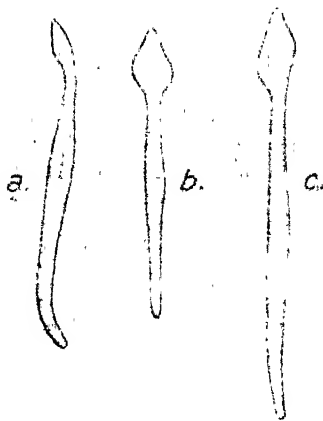
The clitellum is reddish in colour and rather indefinite in extent; it includes segments lv. (?) -c., or liv.-cii. (=46 or 49).

Internal Anatomy.

Septum 3/4 is present; this, with septa 4/5 and 5/6, is scarcely strengthened; 6/7-11/12 are thickened, 7/8-10/11 most so; there is also some slight thickening for several segments further.

There is no œsophageal gizzard, but the beginning of the intestine is strengthened and whitish in colour; the thickening

Fig. 4.



Alma emini: copulatory setæ, from copulatory appendage; $\times 135$.

takes up segments xx., xxi., and part of xxii. The hinder part of the œsophagus, in xiv.-xvi., is very vascular; transverse blood-channels are very obvious in the substance of the wall, and, since the tube bags out laterally in these segments, the appearance at first sight resembles that of calciferous glands.

Hearts are present in segments viii.-xii. The dorsal vessel ends blindly in the anterior part of segment viii.

The nephridia begin in xv. on one side, in xvi. on the other side, of the specimen in which they were more particularly observed.

In segments xiv.-xx., attached to the anterior septum of the segment, is a series of paired structures, white, deeply cut up into lobules, the anterior members of the series taking up nearly the whole length of the segment, the hinder progressively diminishing

in size. On microscopic examination these are found to be "lymph glands"; they consist of masses of round cells which are not enclosed in a capsule of any kind. Many of the cells contain chloragogen matter in amorphous masses consisting of fine granules (not droplets) of a brownish colour. Numerous chloragogen masses are apparently not contained within cells, since they are too large for this—larger, indeed, than the cells themselves.

On the body-wall of segments xiv. to xviii. or xix. are a number of small structures, two or three on each side in each segment, which seem to be of the nature of setal glands. They have the form of semitransparent empty sacs, slightly brown in colour; extracted and examined microscopically, they are seen to be composed of large polygonal cells with very distinct outlines, each containing centrally a cluster of granules, around and partly concealing the spherical nucleus.

Masses of iridescent spermatozoa, which include the male funnels, are present in segments x. and xi. Testes were only doubtfully identified apart from these masses. There are no testis-sacs.

There are four pairs of large lobed seminal vesicles in segments ix.-xii., those in xii. being the largest.

Ovaries and funnels are present in xiii.

The spermathecae are numerous and situated far back. They are small, perfectly simple sacs, elongated in a direction parallel to the long axis of the body, and are disposed in transverse rows ventrally across the middle line, opening between successive segments. The transverse rows are occasionally quite continuous, but usually show an irregular ventral interruption of greater or less extent. A few, empty and excessively minute, are seen as far forwards as 52/53; they begin to contain sperm at 58/59; the last to contain sperm are at 79/80, while behind this again a few empty sacs are continued intersegmentally as far as 84/85. At their greatest extent the rows reach outwards almost to the line of setae *c*; towards the anterior and posterior limits, however, they only reach to *b*, while the minute empty sacs anteriorly and posteriorly are confined to the interval *aa*. All the spermathecae are small and embedded within the body-wall and can be displayed only by stripping off the longitudinal muscular layer; 21, 22, and 23 were counted in a full row, so that the total number will not be less than 400.

Remarks.

The two forms of *Alma emini* hitherto known are distinguished principally by the characters of the spermathecae; in the type-form these are minute and very numerous (up to 18 in a furrow, over 300 in all), in the var. *Aloysii-Sabaudiae* (Cogn.) larger and fewer (usually 4 in a furrow, 42 in all) (*cf.* Michaelsen, 1915); in addition, the clitellum in the type-form is shorter and more anteriorly situated (segments lvi.-lxxxvii. or l.-xciii.), in the variety somewhat more extensive and further back (liii.-c.). In

the present specimens the spermathecal characters are even more extreme than in the type-form—the numbers being up to 23 in a furrow, and at least 400 in all. In the position of the clitellum, however, the worms agree almost exactly with the var. *Aloysii-Sabaudia*, and thus to a certain extent serve to bridge the gap between this form and the type, combining certain characters of both.

It is, perhaps, scarcely worth while to give a separate name to these specimens from Lake Tanganyika; but the interest which attaches to the species will justify the foregoing description of examples from a new locality; and, in addition, the lymph-glands and setal glands found in these worms seemed to deserve a word of mention.

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II. — *Association between Sessile Colonial Hydroids and Fishes**. By E. W. GUDGER, Associate in Ichthyology, American Museum of Natural History.

[Plates I. & II.]

THE term “hydroid” is rather indefinite and is capable of rather wide usage. However, in this article hydroids will be understood to be Coelenterata of the class Hydrozoa, which in typical forms have two stages in their life-history, a sessile or colonied hydroid stage proper, in which the animals are comparable to much-budded freshwater Hydras, and a medusoid or free-swimming stage. Associations between fishes and the medusæ of another great group of the Coelenterata—the Scyphomedusæ—are not uncommon,

* In 1916, Dr. Ludwig Freund, of Prague, published a short popular article under the title “Polypen auf Fischen,” in which he gives brief accounts of some of the cases of association which are set forth in this article. Mention is made of it here to set forth the facts and to include his title in the bibliography.

and there is a fairly large and well-known body of literature describing the living together of young or small fishes and medusæ. The fishes live unharmed under the umbrella of the medusa and even amid its tentacles with their myriad poison capsules. From this abode they sally forth to get food, and to this they retreat on the appearance of danger. The medusæ paralyze with their poison-cells and eat other small fishes, but are not known to harm their symbionts.

Again, there is a less well-known but exceedingly interesting association between certain Anthozoa, or solitary fixed cœlenterates, and fishes—between giant sea-anemones in the Pacific Ocean and certain small percoid fishes. In these cases the fishes abide in the internal cavity of great anemones, departing therefrom to seek food and returning thereto for protection from their enemies.

Furthermore, it is well known that such an association exists between hermit-crabs and ordinary sea-anemones. The anemones, being attached to the univalve shells in which the crab lives, are transported from place to place by the active crab and have a better chance to get food. The crab, on the other hand, is protected by his companion, which can throw into the face or mouth of the attacking fish a cloud of poison-cells. In fact, so strong is the symbiosis betwixt these animals that, when the crab transfers himself to a new shell, he may transfer the anemone as well. This has been seen in the Philippine Islands and reported by Dr. R. P. Cowles in 'Philippine Journal of Science' (1919, vol. xv. pp. 81-88, 2 figs.). In this article Dr. Cowles gives reference to others who have seen the same thing.

It would be interesting to recount some of these more unusual associations, but, since they are all beside the matter in hand, they will be given merely this passing notice. My particular interest just here is in the association (symbiotic, commensal, or parasitic) between colonied hydroids and fishes. While serving as editor of the third and index volume of the 'Bibliography of Fishes,' I became especially interested in this subject. Under the heading "Commensalism and Symbiosis," numerous references were brought together in the Bibliography, and in working up the material for this paper an almost equal number has been added.

To the careful observer, among the most interesting sights at the seashore are the great clumps of colonied hydroids which abound everywhere, attached to piles, old wrecks, stone piers, piles of oyster-shells, and other débris. Using these merely as points of fixation for their hydrorhizas or

holdfasts, they wave to and fro with the tides and currents seeking whatever food the waters may bring to them. That these hydroids may also attach themselves to the hard outer parts of shell-fish and crustaceans is not a far cry. Such associations are well known, and the interested reader will find a considerable number of cases noted in Alcock's paper (1892) referred to later, and in Stechow's work (1911) may be found some beautiful figures of hydroids growing on the hard parts of crustaceans and molluscs. Careful search through the literature would certainly bring to light scores, if not hundreds, of other cases.

SYMBIOSIS.

In this section will be brought together four accounts showing that the hydroids are merely attached to and carried about by the fish. The advantages gained by the former are quick transport from place to place and an enlarged opportunity for food and oxygen-getting over a sedentary life with its dependence upon waves and tides and currents. The benefits to the fish are not so apparent, but presumably it is protected from its enemies by being covered with the hydroid growths, as will be pointed out later when particular accounts are noted.

Sertularia operculata and *Squalus acanthias*.

The first and oldest known account is a note by Thomas Cornish made at Penzance, in England, as long ago as 1868. He writes:—

“On the 18th of March a picked dogfish [*Squalus acanthias*] was brought to me: it was a female, heavy with young, of full age, and apparently healthy; its peculiarity was that with its root or base under and clinging all around the spine of the second dorsal, there was a healthy growing specimen of the sea-hair coralline (*Sertularia operculata*). The coralline had several branches, and was about four inches long: it was growing so firmly on the spine that I could not remove it without destroying the root.”

Seralia lendigera and *Hippocampus ramulosus*.

Our next account is from the pen of Edward Newman some five years later (1873). He says that he was visiting “... a well-known dealer in aquariums and their denizens ... when he invited my attention to a specimen of that

singular fish, *Hippocampus ramulosus*, having an abundant growth of a small and delicate zoophyte [*Seralia lendigera*] on its head, neck, and the anterior part of its body. . . . The fish and its parasite both seemed to be enjoying as much vigour as falls to their respective allotments in life. . . . Nothing certainly can be more stolid than the conduct of sea-horses in general, unless it be that of the branched zoophytes, which are settled for life wherever they cast anchor in their extreme infancy."

Newman identified this zoophyte as *Seralia lendigera* and called it a parasite. This, however, was simply a conjecture on his part, for the basal portion of this animal merely serves as a holdfast. Furthermore, anyone at all acquainted with the tough leathery integument of a sea-horse can well understand the impossibility of even parasitic fungi affecting this animal until the integument is abraded and the underlying tissues exposed. This is no more a case of parasitism than is the preceding.

Stylactis minoi and *Minous inermis*. (Pl. I. fig. 1.)

Alcock (to whose investigations my attention was called more than fifteen years ago) in the article previously referred to, after giving a series of interesting accounts of accidental associations between hydroids and various invertebrates, refers to other associations which seem to be purposive, and then describes what he affirms to be a case of commensalism between a hydroid and a fish. Here are his own words:—

"On March 26th, 1889, there were trawled from 70 fathoms off the Godáviri Delta, on the Coromandel coast, on a bottom of river-borne mud, two specimens of a small fish of the Scorpenoid genus *Minous*, one of which was covered with a fleshy colony of small polyps, which I then thought to be a species of *Podocoryne*. This fish was described . . . as *Minous inermis*, sp. n."

This hydroid was later identified as *Stylactis minoi*. In the trawl that brought up this specimen were fifteen crabs of two species, a number of shrimps, and about three dozen specimens of a gastropod mollusc. The crabs of one species were much infested with foreign growths, among them a gymnoblastic hydroid, but on not a single animal other than *Minous* was *Stylactis* found.

Alcock then continues:—

"*Minous inermis* was not again met with until November 4, 1891, when in a trawl hauled in 45 fathoms off the Malabar coast, on a bottom of sand mixed with a shingle of broken

shells and echinoderm tests, nine specimens were taken, of which all but one were thickly beset, especially round the gill-opening and on the throat and in the axilla, with the same fleshy colonies of the same polyp as was found encrusting the type-specimen of 1889."

The same trawl brought up another species of the genus *Minous*, and five other species of closely related fishes, all ground-lovers. With them were numerous specimens of two bottom-dwelling crustacea, and several hundred living gastropod molluscs of six species. On not one of the fish (not even on the allied *Minous*) and on none of the crabs and molluscs was a single *Stylactis* growing.

Another dredging brought similar results. Of it Alcock (1892) says:—

"*Minous inermis* was found a third time in a small but valuable collection of fishes presented to the Indian Museum by Mr. H. I. Row, a gentleman who has lately been attracted to the still but little appreciated Indian sea-fisheries. In January of this year (1892) Mr. Row dredged a single specimen, in about seventy fathoms of water, somewhere between the delta of the Ganges and that of the Máhánaddi, and along with it numerous specimens of *Minous coccineus*, *Lophius indicus*, *Trigla hemisticta*, Schleg., *Lepidotrigla spiloptera*, Gthr., and *Læops guntheri*, all of which undoubtedly share the habitat of *Minous inermis*. Now, though no epizoon of any sort can be found upon any of these fishes last named, yet the single specimen of *Minous inermis* is coated with the same fleshy polyp-colonies as were found upon this fish on the two previous occasions of its capture."

In this last specimen what were taken for the reproductive parts were well-developed organs, and these give evidence that the hydroid was not a *Podocoryne*, as at first thought, but a *Stylactis*, to which was given the specific name *minoi*—the *Stylactis* of the fish *Minous*. Alcock thought the name justified: first, because *Minous inermis* was never found without the *Stylactis*, nor the *Stylactis* without this particular *Minous*; secondly, because the hydroid was never found on other kindred bottom-living fishes, not even on a *Minous* of another species; and, lastly, because such infested fish had been taken both in the northern and southern halves of the western part of the Bay of Bengal, and also off the south-western (or Malabar) coast of India.

In his title Alcock calls this a commensalism, but later speaks of it as a symbiosis. And just here it may be well to define these terms, together with the term parasitism

previously used. Symbiosis is a general term which means that two organisms live together in such fashion that each receives from the other some benefit however indefinite—as in the case before us, where the presence of the hydroid gives a certain protection to the fish by making it resemble an encrusted stone or bit of wood. Commensalism means living together and sharing food, and is well illustrated by the shark and its attached sucking-fish. When the shark tears a bite off a carcass of some animal, the sucking-fish gets some of the floating fragments and thus shares its host's food. In the third case, parasitism, we have an organism living on its host, at the expense of its host's tissue, in which it produces lesions, and in consequence of this lazy mode of life the parasite itself generally undergoes degenerative changes.

In a later paper (1899) Alcock again reverts to this matter of the commensalism between the fish and the hydroid, and adds the additional information that in a recent cruise of the 'Investigator' on the Malabar coast there had been taken "... no less than 16 specimens... of the fish [*Minous inermis*] all of which have the commensal polyp [*Stylactis minoi*] growing on them."

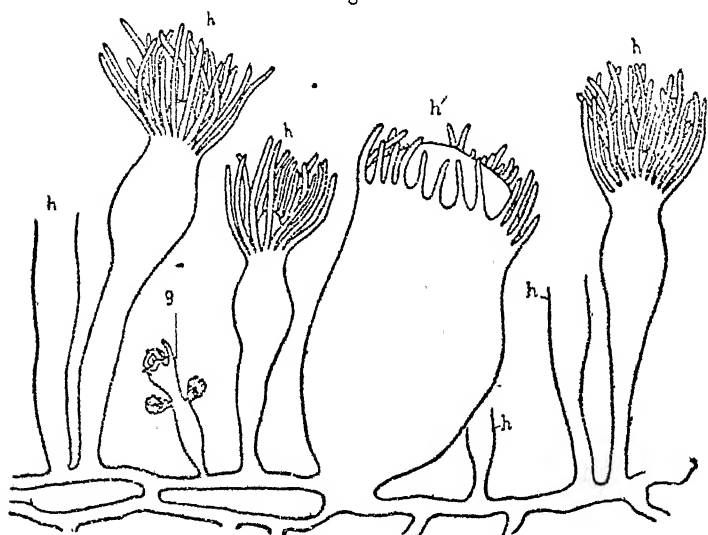
Under the sub-heading "Commensalism among Fishes," Alcock (1901) gives a brief summary of his observations on this association. But still later (1902), when he published his book 'A Naturalist in Indian Seas,' he gives a figure (the first ever published) of the fish and its encrusting hydroid, which is reproduced herein as fig. 1 (Pl. I.). From this book the following quotation sets forth Alcock's views in a brief but very happy fashion:—

"The rock-perches (*Scorpenidae*) almost all either creep about on the sea-bottom or hide themselves in the crannies of reefs, where, by reason of their mottled lichen-like colouring, and by a profusion of wavy cutaneous filaments with which their body and fins are decked, they are difficult to distinguish from shingle and rocks encrusted with seaweed and zoophytes. Instead of frond-like filaments of its own, *Minous inermis* is more or less invested with living hydriform polyps; these always belong to one and the same species (*Stylactis minoi*), and the fish has never yet been found without a coat of these polyps, nor have the polyps ever yet been seen anywhere but on this particular fish. The polyps are not parasites, as is proved by the facts: first, that they have a mouth of the proper form, and tentacles of the proper size and number wherewith to catch their own prey; and, secondly, that numerous individuals can always be

found crammed with food, which must have gone in at their mouth. It is not the sordid bond of parasitism but the happy tie of commensalism which unites these two animals so very wide apart in the scale, and while the fish constantly carries its polyp-friends to pastures new, the polyps in return help to conceal the fish from the watchful eyes of its foes."

My interests are chiefly in the fish, and at first I did not deem it necessary to include figures of the hydroids, but since it has been suggested that the inclusion of these will

Fig. 2.



A much enlarged figure of a small portion of a colony of *Stylactis minoi* removed from its host—*h, h*, nutritive hydranths (some not completely represented); *h'*, a nutritive hydranth gorged with food; *g*, reproductive portion of the colony with what appear to be spores. After Alcock, 1892.

make the paper more valuable, especially to students of the Cœlenterata, they will be reproduced. Fig. 2 shows a portion of a colony of *Stylactis minoi*, copied from Alcock.

However, this is not the last of *Minous inermis* and its symbiont hydroid, for among the fishes collected in Japanese east coast waters by Professor Franz Doflein during the years 1904–05 was a specimen with its associated zoophyte. This was briefly reported on by Franz and Stechow (1908), who say:—

“Professor Doflein collected, in 1904, in Sagami Bay on

the eastern coast of Japan, three examples of this fish [*Minous inermis*], all of which were thickly covered with this remarkable hydroid. Even though it sparingly occurs on the back and upper part of the sides of the fish, it is plain from all the specimens that the hydroid prefers the region between and back of the pectorals and the forwardly placed pelvics and those parts adjacent to the anus."

Having better hydroid material than Alcock, Franz and Stechow are sure that what Alcock took for spore-sacs are really very young but well-developed medusae. The feeding polyps of this hydroid were much larger than in Alcock's material. However, careful examination led them to classify their hydroid as *Stylactis minoi*.

Finally, Stechow (1911), in his monograph on the various hydroids collected on the coast of Japan by Dofflein, made a careful study of the one encrusting the fish. His splendid illustration, reproduced herein as fig. 3 (Pl. I.), shows the fish with a narrow band of polyps on each side along the bases of both dorsal and anal fins, but the shoulder-region and those parts back of the pectorals and the forwardly-placed pelvic fins as far as the vent are most thickly covered. Also there are a few hydroids between the pectorals and the angle of the mouth. Stechow now classifies the hydroid as *Potocoryne minoi*, and notes that the tentacles are somewhat reduced and occasionally absent.

In all these specimens of *Minous inermis* there is no evidence of parasitism. None of the zoophytes showed signs of degeneration and none of the fishes gave any evidence that their tissues were serving as food for the hydroids. The connection seems merely a symbiosis—a living together. However, in symbiosis generally speaking one expects to find that each party gains by the association. That this is true in respect to these two organisms has been clearly put by Alcock above (1892).

Perigonimus pugetensis and *Hypsagonus quadricornis*.

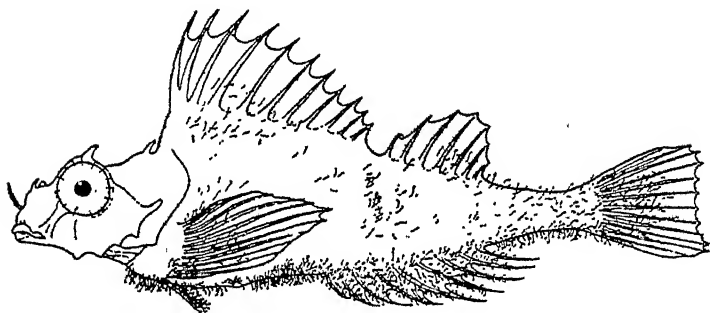
From the Western Pacific we now come to its eastern shore, where in Puget Sound another fish with an associated hydroid has been found. Heath (1910) relates that:—

"During the past summer my friend and colleague, Prof. E. C. Starks, dredged upwards of a hundred specimens of an agouid fish, *Hypsagonus quadricornis*, in Puget Sound, at a depth of approximately forty fathoms. The area over which the dredging extended was in the neighbourhood of Friday Harbor and embraced an area of at least 200 square

miles where the bottom varied from sand to mud. Of the 37 specimens preserved in the Stanford University collection ten of them are coated with a new species of hydroid, *Perigonimus pugetensis*. . . . In every specimen the coelenterate was more abundant on the ventral surface of the body, especially in the axilla, and a luxuriant growth was usually found on the pectoral, ventral, and, to a less extent, on the anal and caudal fins. With one or two exceptions the polyps were much more sparsely distributed over the body and dorsal fins. In no case were they found on the head."

How much Heath's fish differs from Alcock's and Stechow's may be seen on comparing his figure (reproduced herein as fig. 4) with the figures of these authors. It is fairly allowable that all the specimens of *Minous* captured showed a considerable protective resemblance to rocks

Fig. 4.



An Agonid fish, *Hypsagonus quadricornis*, from Puget Sound, bearing scattered colonies of *Perigonimus pugetensis*. After Heath, 1910.

covered with hydroids and seaweeds, but Heath calls attention to the fact that only about one-quarter of the specimens of *Hypsagonus* taken in Puget Sound were thus overgrown with the zoophyte. Furthermore, of the numerous specimens taken by the 'Albatross' in the ocean outside of the sound and in Bering Sea, not one had the symbiont growing on it. Again, this fish is a bottom-dweller, moving about over the ocean floor and producing currents which would bring food to the hydroids which are found more thickly studding the ventral surface of the fish. Hence the advantage of this association seems to be largely on the side of the zoophyte.

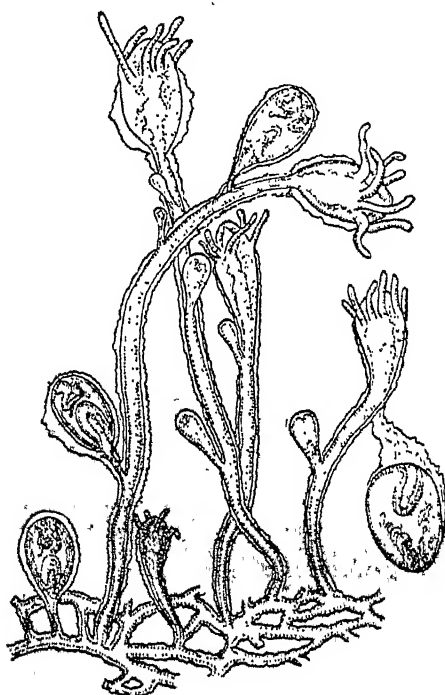
With regard to the kind of association existing between the two animals, Heath states that:—

"As in other members of the genus, the hydrorhiza forms

a highly branched, frequently anastomosing system over the surface of the fish, but so far as noticed this contact is purely superficial, there being no evidence of parasitism. And furthermore the presence of small entomostracans and nondescript organic remains in the gastric cavity of the hydranths shows the feeding processes to be those of a non-parasitic species."

In fig. 5 is shown, much magnified, a portion of a colony of this hydroid to illustrate Heath's remarks.

Fig. 5.



Portions of the colonied hydroid, *Perigonimus pugelensis*, showing hydrorhiza, hydranths, and budding medusæ. After Heath, 1910.

Before leaving this case of association, it may be of interest to note that there are records of at least five other species of *Perigonimus* living attached to the tests of ascidians, to crustaceans, and to the shells of living molluscs. Hence the transition to the habit in another species of living on a bottom-dwelling fish is not a very violent one. The association is, however, probably more or less accidental,

whereas that between *Stylactis minoi* and *Minous inermis* seems to be obligate.

ALLEGED PARASITISM BETWEEN HYDROIDS AND FISHES.

We now come to a consideration of those cases of association which the investigators, who have been so fortunate as to discover them, declare are instances of parasitism. Here it will be noted that the investigators present evidence that the hydroids are somewhat degenerate (generally in the structure of the feeding organ), or that the host shows some evidence of lesions at the point of attachment of the hydroids. Discussion of the accuracy of these allegations will be entered into in the consideration of each case.

Hydrichthys mirus and *Seriola zonata*.

In 1887, Dr. J. W. Fewkes published in 'Nature' a preliminary note announcing the capture at Newport, R.I. (U.S.A.), of a fish having an attached hydroid which he believed to be living parasitically on the fish. He found the presumed parasite to consist of a basal plate and two kinds of individual tubules arising from it—gonosomes and filiform bodies. Both of these bodies were destitute of tentacles, but the latter had each a terminal mouth. During the following year Fewkes published an extensive illustrated paper (1888 a), "On Certain Medusæ from New England," and among them the medusæ budded off by this hydroid. In this paper he goes carefully into the matter in hand. We will let him speak for himself :—

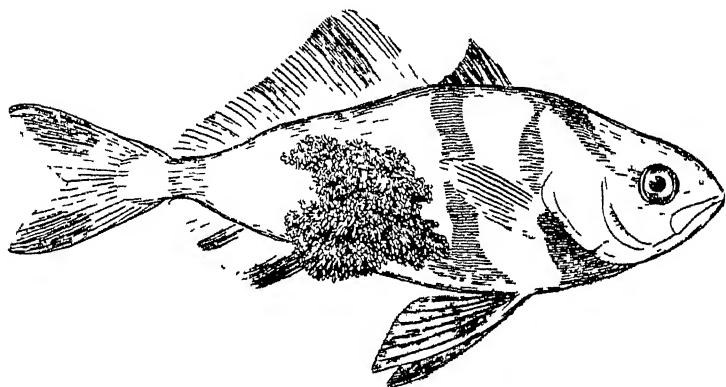
"During the month of August of the past summer (1887) in the surface-fishing carried on at the Newport Marine Laboratory, I captured a most interesting genus of parasitic hydroid [*Hydrichthys mirus*]. This genus and its peculiar life are undescribed as far as known. The mode of parasitic life is most extraordinary, and the modifications of its structure of an anomalous character.

"A small fish of the genus *Seriola* (*S. zonata*, Cuv.) was taken in a dip net at a time when the sea was quiet. (The *Seriola* was in company with two others. Neither of its companions, however, were affiliated with the parasites mentioned above.) Upon the side of the body [fig. 6 herein] and near the anal opening of this fish a patch of reddish-colored bodies was noticed. The patch was at first supposed to be a fungoid growth from a wound or abrasion of the body. A more careful examination of the supposed fungus

showed me my error, and revealed the fact that it was an attached animal with true hydroid affinities. The fish with the attached hydroid was kept alive in an aquarium for some time, and from the hydroid many medusæ of interesting relationship developed. Thousands of these medusæ were raised."

Fewkes found this hydroid to be unusual not only in its habitat but in its anatomy also, the latter being entirely different from any other hydrozoan known to him. He thought these modifications of structure to be due in part at least to the attachment to the fish, and since the hydroid had never been found elsewhere than on the fish he believed that it "may mean that we have in this genus a case of

Fig. 6.



Seriola zonata, a Carangoid fish, with its attached colony of *Hydrichtys virius*, taken in the waters, Narragansett Bay, U.S.A. After Fewkes, 1886.

parasitism or possibly commensalism, and that this condition has rendered functionally useless or modified the form of certain structures commonly present in other hydroids, while it has increased in relative size and possibly importance other organs, especially those of reproduction and dissemination of the young." What these modifications are he indicates (at least in part) in the next paragraph:—

"It was impossible to determine how much nourishment the hydroid *Hydrichtys* draws from the fish upon which it lives through the network of tubes from which the gonosomes and filiform bodies arise. The absence of tentacles, or organs the function of which is the capture of food, would seem to deprive *Hydrichtys* of those means of capturing and

drawing food to the mouth which are almost universal among fixed hydroids. Possibly in its parasitic life the hydroid obtains its sustenance from the fish on the sides of which it lives.

"The question whether the fish ultimately succumbs to the parasite is an interesting one, but one which cannot be definitely answered at present. The only specimen of *Serrula* captured which was infested by the hydroid appeared to be well and healthy and lived for a considerable time without exhibiting any inconvenience from the attached parasite. The muscles of the fish, however, under the 'basal plate' of the hydroid seemed somewhat wasted; and after the fish was killed, the shrinkage in its body walls seemed to indicate that the fish had not wholly enjoyed its strange companion."

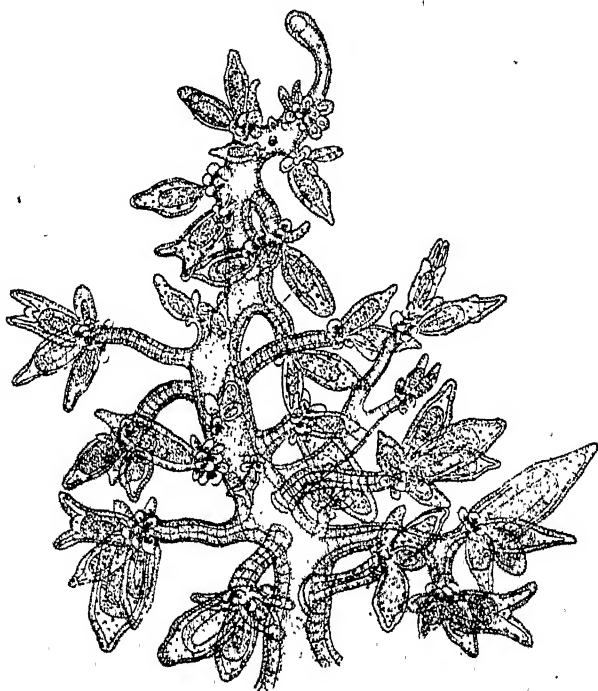
Fewkes's figure is reproduced herein as fig. 6. The base of attachment of the hydroid was about three-fourths of an inch long and was "a thin flat plate with ramifying tubes, by means of which the colony is attached to the fish," and from which the various organs of the colony extend outwards. He affirms that this plate is not peculiar to this hydroid but is such as is found in many other attached hydroids, being leathery and coriaceous, smooth above and below, and devoid of any organs for absorption. However, it was so firmly attached to the fish that "it was with difficulty broken away. I was obliged to cut it off, and with the hydroid thus dissected portions of the body of the host were also ruptured."

This seems to make out a pretty strong case. There is here a certain degeneration in the feeding-organs of the hydroid—the lack of tentacles around the mouth of the hydranths—a very strong and firm attachment to the host apparently amounting to a veritable anastomosis, and an apparent weakening of the tissues of the host. However, one wonders how such a smooth leathery basal plate could have abstracted food-materials from the scale-covered sides of the fish. There is no indication of any organs of absorption in the smooth basal plate. It is conceivable that were this plate seated on a raw surface of tissue there might be a solution and absorption of the protoplasmic materials. The strong attachment of the basal plate to the scales is merely what it would be were the hydroid seated on a pile or on a stone—merely a holdfast fixation. Had Fewkes cut sections and found an actual anastomosis of the tissues of the two animals, parasitism would have been pretty conclusively shown. The "wasted and shrunken condition" of the body-walls, while apparently an argument for parasitism, does not prove it. To the present writer the proof is lacking.

It is to be regretted that Fewkes gives no figure of the colony as a whole, basal plate and all. He does give a figure of the gonophore, which is reproduced herein as fig. 7. He also figures a filiform body in two views and a medusa-bud in section, but these are of no significance here and need not be reproduced. What is wanted in this connection is a section through a whole colony.

Fewkes read a special communication on this remarkable

Fig. 7.



A cluster of gonophores of *Hydrichthys mirus* separated from the basal plate by which the whole colony is fastened on to its fish host. After Fewkes, 1886.

find of his before the Boston Society of Natural History (1888 *b*), and it aroused so much interest that the entire article was reproduced in England in the 'Annals and Magazine of Natural History' (1888 *c*). Further, the article was abstracted at least three times in the year of its original appearance (1888), as is noted in my bibliography.

Seriola belongs to the family of the mackerels, and with

regard to the common mackerel, *Scomber scombrus*, Fewkes tells (1888 *b* and 1888 *c*) an interesting story which he had heard from an Italian fisherman—that the Scyphozoan medusa, *Velella*, originates from a bud on the head of the mackerel. The account is *à propos* just here since “*Hydrichthys* is, in point of fact, the nearest known ally of *Velella* among fixed Hydroids.” These affinities between the two hydroids Fewkes has already shown, and they need not be gone into here. Our author states that this story had already been recorded by Marcel de Serres and by Pagenstecher. He gives no citation nor information beyond the bare statement. However, after much searching the citations were located and will now be given.

In 1808 Serres described *Velella*, and in the course of his paper has the following highly interesting paragraph, which it seems well to quote in its entirety:—

“Along the Mediterranean, this species is sometimes thrown ashore in such abundance that off the French coast, in the Midi, it forms a kind of blue streamer, even more remarkable because of its colour. It is found principally at those times when the mackerel (*Scomber scombrus*, Lin.) are most abundant—that is, during the months of May and September. The Mediterranean fishermen call this radiate *Flou d’aou vérat* (flower of the mackerel) because of their belief that it lives on the head of this fish. I have not been able to make sure that this observation is exact; it is, however, odd, because of the size of the radiate in proportion to that of the fish on which it is said to be a parasite. It is impossible not to doubt the truth of this assertion considerably, in spite of the accord of the fishermen in regard to the manner in which this radiate lives. Columna reports that the Italian fishermen think the zoophyte springs from the ianthine (*Ianthina fragilis*, Lamarck), and it is possible that our own fishermen are no more accurate in regard to the habitat of *Velella* than are those of Italy in regard to its origin.”

Pagenstecher (1863) was collecting and studying marine invertebrates at Cette in 1862 when he met Serres, then a professor at Montpellier, who had made his observations on *Velella* at Cette prior to 1808, where Pagenstecher more than a half-century later made his also. The latter offers, as an explanation for the belief of the fishermen cited by Serres, the facts that at the mackerel-catching season the fish and the *Velellas* are found together in the nets, and the *Velellas* are not infrequently found clinging to the mackerel. This point as to the abundance of *Velella* on

the shore at Cette at the mackerel-catching season, I have been able to verify in another writer whose observations covered quite a term of years.

A possible and an even more probable explanation of the above bit of folk-lore is to be found in the association previously referred to of various small fishes (and particularly mackerel-like forms) with various Scyphomedusæ. And just here it seems well to correct a note in "Les Cœlentères" (part of the 'Traité de Zoologie Concrète,' vol. ii. part 2, Paris, 1901) of Yves Delage and Edgar Hérouard. On page 369 they say "*Crambessa* has been found fixed on the head of the teleostean fish *Caranx*." No reference was given, but presently I ran down in Lunel (1883) what I believe to be the original account serving as a basis for the statement above. Lunel cites numerous accounts wherein it is alleged that large Scyphomedusæ feed on small fishes and gives the following statement concerning a *Caranx* and a *Crambessa* sent him from Mauritius in 1882, preserved in alcohol:—

"The former of these animals [*Caranx*] was fixed by the greater part of its body in the apertures formed by the four columns which unite the stomach to the umbrella in the latter [*Crambessa*] . . . the fish only lodges itself in a natural cavity of the Medusa . . . This cavity is widened by the prolonged use which the fish has made of it, but nevertheless the *Crambessa* is perfectly uninjured—an evident proof that the fish regards its associate as a place of refuge."

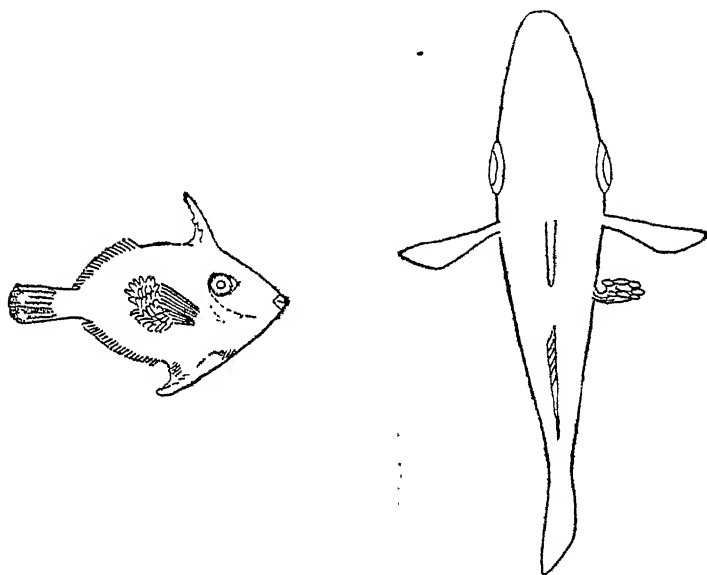
Nudiclava monacanthi and *Monacanthus tomentosus*.

The next account of this extraordinary kind of alleged parasitism is Lloyd's description (1907) of a *Nudiclava* growing on a filefish (*Monacanthus*). This fish with its attached hydroid was taken in a tow-net by the 'Investigator' in the Andaman Sea in 1897, but it was not examined until some ten years later. As may be seen from Lloyd's figures (reproduced herein as fig. 8, A & B), fish and hydroid are small (the former only 18 mm.—three-fourths of an inch—in actual length). The most marked characters of the hydroid were the large number of club-shaped hydranth-like bodies devoid of tentacles, and the basal plate attached to the skin of the fish and having the club-shaped bodies arising from it as shown herein as fig. 9. "This basal plate consists of a labyrinthine system of irregular spaces and tubules."

Lloyd's title calls the hydroid a parasite, and the fact that the hydranths lack the tentacles, the food-procuring organs,

argues for it. Furthermore, he states that in his specimen the basal plate was so closely attached to the skin of the fish that in pulling it off "an outer layer of the fish's skin is often detached with it." He cut sections of this, but his figure does not show any penetration into the tough leathery skin of this Balistid fish. However, Lloyd compares his materials with Alcock's and with Fewkes's, and calls *Stylactis* and *Hydrichthys* parasites. But it will be recalled that while Fewkes thought that his material showed para-

Fig. 8.



Two diagrammatic views of the Balistid fish, *Monacanthus tomentosus*, from the Andaman Sea, with its attached hydroid cluster. A, the fish $\times 2$ (i. e., 36 mm. long); B, $\times 4$, with the parasite drawn fully expanded. After Lloyd, 1907.

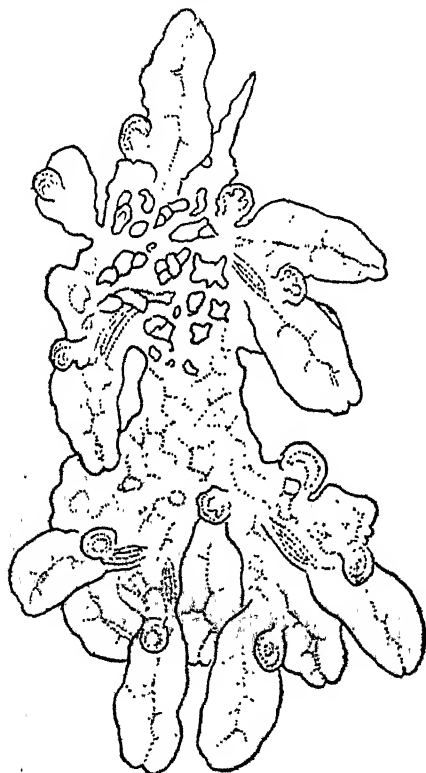
sitism, Alcock claimed no more than commensalism for *Stylactis*.

Now the final test of such a parasitism is the destruction of the skin of the fish under the basal plate of the hydranth and the absorption of the tissues as food by the hydroid. On this point here are Lloyd's own words:—

"It seems from the following observations that the genus *Nudiclava* does not obtain sustenance from the fish to which it is attached. It was previously mentioned that on removing

a portion of the colony an outer layer of the fish's skin was removed with it. Part of this was separated from the hydroid and examined microscopically; it was found to be quite intact; there was no sign of perforation by radical organs. In the absence of such special organs, it does not seem likely that the fish would be so accommodating as to

Fig. 9.



A much magnified portion of colony of *Nudiclara monacanthi*, showing disc by which it is attached to the fish and the hydranths and gonophores which project from it. After Lloyd, 1907.

diffuse nutriment, uncompelled, through its own skin into the tissues of the hydroid."

Answering his own question how this tentacleless hydroid could obtain food, Lloyd, after a study of the well-developed double-layered cellular structure of the hydranths, concludes that each hydranth expands the mouth into the shape of a

wide funnel, and that since there were about five hydranths in the colony, these mouths would altogether when stretched equal the area of the open mouth of the host-fish. This and the statement in the preceding paragraph being taken at their face values, one then wonders why Lloyd should have given his article the misleading title which heads it. The possible wide distension of the mouths in the search for food probably explains how the zoophyte feeds, and Fewkes's hydroid also probably fed by the mouth at the apex of each filiform body—in one or more of which remains were observed of what was undoubtedly food-material.

PARASITISM OF HYDROIDS ON EGGS AND ON FISHES.

Curiously enough, the first account of actual proven parasitism was not between hydroid and fish but between the hydroid and the eggs of a fish, and, most remarkable, between the hydroid and the *eggs in the ovary of the fish*.

Polypodium hydriforme in the Ovarian Eggs of *Acipenser ruthenus*.

One of the earliest students of the embryology of the sturgeon was Filipp Vasilievich Ovsyannikov, and in the course of this work he made the discovery of a hydroid living parasitically in the ovarian eggs of the sterlet of the Volga. Early in 1872 he published a preliminary note on the parasite, which he described as forming a spiral stolon with numerous buds within the shell of the egg. After a short immersion of the eggs in the water, the shell bursts and sets free the parasite. Later in the same year, Ovsyannikov published a fuller account, but so far as our interests herein are concerned it merely confirms and somewhat expands his preliminary account. The infected eggs were grey in colour, whereas normal sterlet eggs are dark like those of frogs. They were also somewhat larger than normal eggs, and many showed a black streak across the upper surface. The body-cavity of this hydroid, when set free, was at first filled with yolk, but this finally disappeared. From a study of these conditions Ovsyannikov pronounced the hydrozoan to be a parasite on the sterlet egg during the early stages of its life-history. He concludes his communication by promising a fuller and more complete article. Of this, however, careful search has revealed no trace.

The next worker on this phenomenon was O. Grimm, one of Ovsyannikov's students, who in 1873 published an article

in Russian dealing with his studies on certain invertebrates. In this he confirms Ovsyanukov as to the presence of the parasitic organism in the egg of the sturgeon, but concludes that it is the larva of a planarian worm. Yet he figures a hydra-like animal which escapes from the eggs after spawning. Grimm adds nothing to our knowledge and need not detain us.

Thirteen years went by before any further addition was made to our knowledge of this extraordinary phenomenon. Then, in 1885, Ussov published at Kasan, on the Volga, an article bearing the title "A new Form of Freshwater Coelenterate." His paper being in Russian was not easily available for other scientists, so Ussov translated it into German and published it anew in the 'Morphologisches Jahrbuch' in 1886. Here it attracted such widespread attention that it was again translated (this time into English) and published in 'Annals and Magazine of Natural History' late in the same year, and an abstract appeared in the 'Journal of the Royal Microscopical Society' for 1886. In this rather extensive article, Ussov says that it is more or less a preliminary one and that he is preparing a "large memoir" for publication later. This apparently never saw the light, at least I have been unable to find it in the bibliographies of Coelenterata.

To this organism Ussov gave the name *Polypodium hydri-forme*—the many-footed, hydra-like animal,—by which it is known to-day. His investigations went rather fully into its parasitic life in the ovarian eggs of the sterlet and into its asexual method of reproduction, and very markedly advanced the knowledge of this peculiar parasite. The following data are taken from the English translation noted above. Both figures and text are very interesting.

Remarkable to say, the parasite is found in the unspawned eggs in the ovary of the fish, and this Ussov attempts to show in his fig. 1 (no. 1 of my fig. 10, Pl. I.). However, I am unable to make out any parasites in these ovarian eggs. But in nos. 2 and 3 of my fig. 10 (Pl. I.), Ussov portrays, much magnified, two eggs with the parasite encircling the yolk; and in no. 4 of my fig. 10, the hydroid organism itself, also greatly enlarged. The full-grown worm-like or stolon-shaped organism in natural size (*i. e.*, at about the time of spawning of the sterlet's eggs) measures about 20 mm. long by about 0.75 mm. broad, has neither mouth nor anus, and has all the buds strung along one side or margin.

How the infection takes place Ussov did not find out, but

his researches did show : (1) that the proportion of infected ovaries is low—about two out of ten ; (2) that the disease is somewhat dependent on the age of the fish, the ovaries of fishes of 50–70 cm. long are more often parasitized than those of 20–25 cm. ; (3) fishes that have lain in the boats for some time are more parasitized than freshly caught specimens ; (4) ovaries with bright-coloured yolks have most parasites, while in those having fatty yolks the parasites die quickly ; (5) that fishes from the lower Volga are more infected than those around Kasan ; and (6) that the disease is most abundant and virulent from August until January, or slightly longer. It should be noted just here, before leaving the subject, that the light colour of the eggs depends not so much on their age as upon individual peculiarities of the sturgeon.

Ordinarily one does not find anything particularly noticeable either in ovary or eggs, because the parasite is inside the ovarian egg and in the early stages the long, worm-like stolon is immobile and almost invisible. The ovaries of the sterlet ripen in April–May and the parasites are also then well developed, consequently not infrequently the egg-shell, stretched by the growth of the parasite, breaks, and parasite and yolk fall into the lumen of the ovary. However, if the infected eggs (from 3 to 4 mm. in diameter) are spawned with their shells intact, it is found that such eggs are slightly larger (by 1 or 2 mm.) than the normal uninfected eggs, and if examined carefully a white spiral coil with swollen wavy walls will be found to run all over the egg just underneath the shell, through which it is visible (see nos. 2 and 3 of fig. 10, Pl. I.).

If the shells of infected eggs burst while the eggs are in the ovary, the parasites die ; and even if these unripe eggs are extruded into the water and their shells burst or are opened, the parasites die. Water, which is so necessary for their later life and development, is absolutely fatal in their earlier stages. In early stages the spiral turns of the worm-like parasite follow the long axis of the egg of the fish as may be seen in nos. 2 and 3 of fig. 10 (Pl. I.), no. 3 being a polar view of the egg. Further, it should be noted that the parasites are found in well-developed eggs only, never in immature ones.

The proofs of parasitism in this phenomenon are :—first, the presence within the egg-shell of the alien organism (the vermiform hydroid) ; secondly, the fact (according to Ussov) that the ectodermal cells of this, which are in contact with the yolk of the egg, are filled with yolk-bodies which have

been taken in by these cells without any breaking up ; and, finally, there is the added proof that "... the process of nutrition, which is more and more actively carried on during the growth of the ... buds, is performed exclusively by the ectodermal cells of the buds, the vitellus of the ovum which is energetically incepted by the latter, penetrating through the endodermal cells into the bud-cavity where it collects in the form of reserve nutritive material" for the later nourishment of the animal. If egg and parasite are undisturbed this process goes on until all the yolk has been absorbed by the parasite and there is nothing left within the shell but a brown excretory product given off by the parasite. All this time the buds with their tentacles are growing, and Ussov expressly says of the latter that "they grow from *without inwards* into the cavity of the bud, in the fashion of inverted glove-fingers." This may be seen in no. 6 of my fig. 11 (Pl. II.), where the bases of the tentacles show up as black dots on the outer ends of the buds.

At about this stage spawning takes place, and the friction set up during this process, aided by the growth of the hydroid with its well-developed buds, generally causes the shells of the infected eggs to burst, and the parasites to be set free in the water which is now vitally necessary for their life. Generally, within twenty-four hours after extrusion into the water, the hydroid breaks up into thirty-two pieces corresponding to the thirty-two buds. If, however, the shells burst while the eggs are still in the ovarian sac, the parasites inevitably die.

Fig. 11 (Pl. II.), copied from Ussov, shows two stages in the development of the stolon with its buds, taken from a sterlet egg at about the stage of spawning. Ussov's no. 5 represents a stolon with well-developed buds having the tentacles on the inside. No. 6 shows the buds much enlarged ; the dark points are the bases of the tentacles. No. 7 shows the stolon with everted buds and tentacles. This latter would certainly seem to be a colonied form.

The later history of *Polypodium* is very complex and is of no particular interest just here. Ussov conjectures that there is a sexual stage or generation giving rise to a planula which penetrates the genital orifice and ovary of the sterlet and finally enters an egg, presumably through the micropyle in the egg-shell, there to begin the process of development which has been described.

Twenty-three years elapsed before any further work was done on *Polypodium*, and then there was great activity in its study—chiefly along morphological lines. This work was

done by three Russians, of whom Lipin was the chief. Him we will consider later. Of the others, Dershawin (1910), working at Astrachan, at the head of the Volga delta, found two free-living, medusa-like forms of *Polypodium* at a depth of fourteen metres in one of the tributaries of the Volga. In 1911 and 1912 he found a considerable number in the same spot. Dershawin points out that these free-living forms must have been three months old—the oldest ever found at that time.

Behning (1913), the other investigator referred to, dredged in July in the side-streams of the Volga near Saratov, and caught several free-living forms of *Polypodium*. He also captured a number of sturgeons from 1.5 cm. long up—this latter stage being about two and a half weeks old. From these data he leans to the conclusion that the sturgeons become infected while relatively young.

Lastly, we come to the man who has most carefully and extensively studied *Polypodium*, unfortunately for us not so much as a parasite as from the standpoint of embryology and morphology mainly. In the first of his extensive series of papers (1909) Lipin, from studies at Kasan, confirms the observations of Ovsyannikov and Ussov as to the parasitic stolon found in the eggs of the sterlet just before spawning. He finds the same differences in size and colour between uninfected eggs and those having the spirally wound stolon surrounding the yolk as had previously been reported. This stolon he found plainly visible under the microscope. He confirms Ussov that the mouthless and anusless stolon forms buds, and that these buds have tentacles inside of them. But, in contradiction of Ussov, he finds the endoderm forming the *outside* layer of the organism and hence bathed in the yolk of the sterlet egg. He finds also that no yolk is taken into the ectoderm cells, but that about the time of spawning the polyps become everted and their food-cavities are filled with the egg-yolk upon which they live until they become fully separated from each other, adult, and free-living.

It is a most extraordinary fact that the germ-layers in the buds and stolon are in reversed position—*i. e.*, endoderm outside. For the buds this abnormal condition is set straight when the polyp-buds burst out. This is done in the following fashion: as the buds develop, their tentacles grow down through the basal part of the bud and produce an outpushing on the side of the stolon away from the bud. The swollen part breaks and, through the split, the bud pushes out, turning itself inside out as it does so, thus

bringing the former inside-lying ectoderm to the outside of the polyp-bud. During this process the cavity of the everting bud becomes mechanically filled with the yolk of the sterlet egg, and the endoderm is still bathed with food-material. About this time spawning takes place, the stolon is set free in the water, and the polyp-buds break away each to begin its free life, but for the time being well supplied with food.

In 1910 *a* & *b* and in 1911 *a*, Lipin published, in Russian, three papers giving certain results which he had attained in his work on *Polypodium*. These will be found listed in the bibliography, but since their data is obviously included in the paper next to be referred to no attempt has been made to translate them.

In 1911, Lipin published in German a second very extensive paper in which he brought together all his observations and conclusions concerning the structure and way of living of this elsewhere unknown Coelenterate. This paper was based on a larger amount of material than he had had before, but that part of it of interest to us here may be quickly summarized. He finds that the buds are not fixed at thirty-two as Ussov thought, but vary in number from sixteen to sixty-four (the latter number being found in several specimens). These are all on the same side of the stolon, and as they become depressed inwardly they put pressure on the wall of the stolon opposite them. This splits longitudinally, and it and the buds all turn inside out and the cavities of stolon and buds become filled with yolk. The longitudinal slit then heals and the buds and stolon have the germ-layers in their normal position—ectoderm outside, endoderm inside.

After spawning takes place, *Polypodium* bursts the egg-shell, and takes up its free life in the water. Then the stolon with its buds breaks up, not regularly as Ussov thought, but in parts with varying numbers of buds. These parts break up finally into individual free-living hydroids with twelve tentacles. This process is very complicated, abounds with variations, and need not be entered into here. Finally, Lipin concludes that stolon and buds form not an individual but a colony.

In the meantime, Lipin devoted himself to the search for younger stages of the parasite in the egg and older stages living free in the Volga. And while working at Saratov in November 1910, he found younger stages parasitic in eggs in unripe ovaries, but he gives (1911 *c*) no figures and his descriptions are not clear. In only one of the sterlet ovaries

investigated did he find infected eggs—and only two of these. They were larger than healthy eggs and their contents were clearly divided into two parts: one of a yellow colour, the healthy yolk; the other containing the parasite, light grey in colour and semi-transparent. The parasites turned out of the eggs showed up as two lumpy objects with uneven surfaces, one being somewhat elongated. The fixing and preserving agents used acted poorly, but when the parasites were sectioned, Lipin found that in this stage they have the germ-layers in normal position—*i. e.*, ectoderm outside. He was unable, however, to offer any explanation as to how the reversed condition (endoderm on the outside of buds and stolon, ectoderm inside) came about. Lipin does not speak of either mouth or anus in this stage, and both are absent later, hence one is at a loss to understand how this reversal could take place. However, he emphatically states that the germ-layers are in their normal position.

In 1915 Lipin again published a very large paper, also in Russian, dealing with the adult form, with the phylogeny and systematic position of *Polypodium*. In this he says that he found the gonads and what he took to be an embryo in the oldest stages. He came to the conclusion that *Polypodium* belongs to the Scyphomedusæ and that it is near to *Paraphyllina* found in the Mediterranean. It is greatly to be regretted that this extensive paper has no résumé in French or German.

In his material described in 1915, Lipin had adult specimens with ripe gonads. In 1922 he discusses their number and position and the fact that they can disappear and be re-developed in different places and numbers, but apparently since this date he has published nothing on *Polypodium*, and the questions as to its method of sexual reproduction and to us the consequent one of greatest interest of how the ovarian eggs of *Acipenser ruthenus* become infected, are as yet unsolved. It is greatly to be hoped that Lipin, who has made *Polypodium* his particular field of investigation, may persevere until he has solved the enigma.

Hydrichthys boycei on various Fishes.

In a preceding section I have considered at some length the presumed parasitism of *Hydrichthys mirus* on *Seriola zonata*, and after careful study of the account given by Fewkes (1886) have been forced to return at best the Scotch verdict "Not proven." Now, however, we will study a case of proven parasitism by a hydroid of the same genus found

in the waters of Durban Bay, South Africa. This is reported by Dr. Ernest Warren (1916), Director of the Natal Museum, from preserved material, which, however, was examined alive by Messrs. E. C. Chubb and David Boyce of the Durban Museum. Mr. Boyce discovered the first parasitized fish, and indeed kept it and other specimens under observation for some time in an aquarium.

Here are the facts about this remarkable find :—

“The first specimen obtained was found attached to the dorsal fin of a small fish about three-fourths of an inch in length. The colony appeared as a small cluster of individuals forming a somewhat conspicuous reddish mass about 12 square millimetres in area and 2.5 mm. in height. Subsequently about a dozen colonies of varying sizes were collected. They were attached to various parts of the fish : the surface of different fins, the sides of the body, the dorsal surface of the head, and the caudal portion of the body.

“At least three species of fishes were attacked. One young specimen of a certain species of the Glyphidodontidæ was found infested, but the majority of the material was obtained from young specimens of a species of *Mugil* ; and the fish locally known as the ‘silver’ (*Ambassis natalensis*, Gilchr. & Thomp.) was also attacked.”

Each colony of hydroids, much transformed by its parasitic habit of life, consists, as may be seen from fig. 12, of a basal plate-like hydrorhiza bearing hydranths and gonostyles. This irregularly-lobed structure is firmly attached to the surface of the body of a fish or to a fin as shown in the figure, but it possesses no tubes of any kind. The plate grows at the edges, which gradually extend out over the surface parasitized. Sections show that this basal plate sends into the body of the fish haustoria-like prolongations covered with columnar epithelial cells possessing processes which penetrate between the cells in the tissues of the host and actually absorb them.

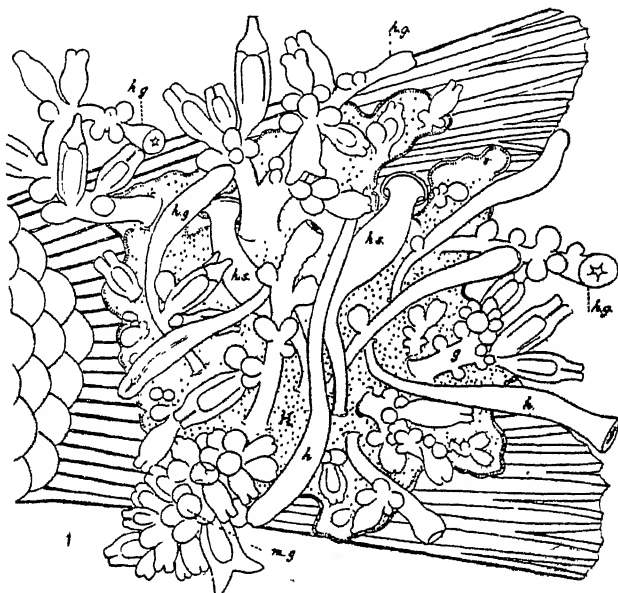
These details are shown in an enlarged figure of such a section figured by Warren on pl. xxvii., which is reproduced herein as fig. 13 (Pl. II.). This figure absolutely establishes the fact of parasitism, for on the left one of the haustoria has penetrated a blood-vessel and the corpuscles are being drawn up into the cavity of the basal plate.

One of the essential proofs of parasitism has been given—that of an intimate physical connection of parasite to host by haustoria,—but Warren brings forward additional proofs. The hydranths have no tentacles for catching prey, and “food in the form of captured prey has never been seen in

the digestive cavity of the hydranths." However, since the mouth of each hydranth is capable of considerable distension, some floating food may be captured and taken in, but its chief food-supply undoubtedly comes from its host. As to this, it seems best to let Warren speak, his remarks being understood as based on the evidence of his sections. He writes that:—

"The polyp is capable of bending down to the surface of the fish and of forcing its widely opened and reflexed mouth

Fig. 12.



Hydrichthys mirus, a colonied hydroid growing on the caudal fin of a Teleostean fish from Durban Bay, South Africa. H is the plate-like hydrorhiza; h., the hydranths; h.g., hydranths bearing medusae; h.s., hydranths sucking blood; m.g., massive upgrowth bearing clusters of medusae. After Warren, 1916.

into the injured tissues, and there tapping the blood-vessels. The blood is sucked into the digestive cavity in considerable quantities. In one case a large mass of connective tissue had been similarly engulfed. It is perhaps doubtful whether the hydranth is capable of penetrating the uninjured epidermis of the fish. In all the cases observed the hydranth had pushed itself into subcutaneous tissue from which the adjacent epidermis had been removed by the basal

plate. It is probable that the basal plate is capable of contracting away from the place where a hydranth is about to dip down into the tissues. The blood-corpuscles of the fish may be found in the coelenteron of any part of the hydroid. The hydroid is thus very effectively nourished, for not only is there an ample supply of plasma, but the red corpuscles themselves appear to be digested to a certain extent, since some of those which lie in the coelenteron seem to be shrivelled and disintegrated; also, the endoderm cells are capable of ingesting the corpuscles. In this connection it may be noticed that definite spaces in which lymph must be collected frequently occur between the basal plate and the dermis of the fish, and it is clear that this fluid could be readily absorbed by the inner ectoderm of the basal plate."

This leaves no doubt as to the parasitic manner of life of this hydroid. Warren has absolutely and unequivocally proved his case. He refers to Fewkes's find of *Hydrichthys mirus* on *Seriola zonata* and of its supposed parasitism, and thinks it extremely probable that it gets its nourishment in the same manner as does his *H. boycei*. And it must be confessed that his evidence does lend great credence to Fewkes's conjecture. However, the South African parasite does not seem to tend to cover the whole fish nor to produce death in its host, according to the observations of Mr. Chubb and Mr. Boyce. No dead fishes with the hydroid on them were ever found, but fishes with scars on their sides and with hypertrophied fins having attached fragments of the hydroid were collected, and at least one fish was seen to free itself of its hydroid by jerking motions. Hence it would seem that at a certain stage, probably when it has produced medusæ, the parasite either dies or its hold becomes so relaxed that it can be shaken off by the fish. This fact is, indeed, quite as remarkable as is the fact of parasitism.

RÉSUMÉ.

1. There is a symbiosis between *Sertularia operculata* and *Squalus acanthias*, and between *Serialia lendigera* and *Hippocampus ramulosus*—there being but a single case reported for each pair of organisms. It is probable that these associations are entirely accidental.

2. Of *Stylactis minoi* and *Minous inermis*, no fewer than twenty-nine specimens of the fish (presumably all ever taken) wherever found—and they have been taken from five widely distant stations on both coasts of India, and from Japan—were infested with the hydroid. Furthermore, so

far as known, this particular hydroid has never been found save on this particular fish (*inermis*). These facts would seem to indicate that this is a purposive or obligate symbiosis.

3. About one hundred specimens of *Hypsagonus quadricornis* were taken in Puget Sound. Thirty-seven of these were preserved, and ten of them were found to be sparsely covered with *Perigonimus pugetensis*. Other specimens of the fish taken outside Puget Sound and in Behring Sea all lacked the hydroid. Consideration of all these facts leads to the conclusion that the association is symbiotic and more or less accidental.

4. One case has been presented of *Hydrichthys mirus* attached to *Seriola zonata* in Narragansett Bay. Parasitism is alleged, but the proofs offered, that there was some apparent degeneration on the part of the hydroid and some slight evidence of wasting away of the muscles of the fish at the point of attachment, are at best inconclusive, there being no evidence from sections presented to show actual anastomosis of the tissues of the two organisms. From the evidence presented one must conclude that this is only a case of symbiosis.

5. One case is known of the attachment of a *Nudiclava* to a fish, *Monacanthus*, from the Andaman Sea. Parasitism is alleged in the title of the paper, but disclaimed in the text, since, in sections cut through the basal plate and the skin to which it was attached, such was not proven. Furthermore, the finding of food in the hydranths discounts the idea of parasitism. This case also must be classed as a symbiosis.

6. True parasitism has been repeatedly shown to exist between an aberrant hydroid, *Polypodium hydriforme*, and the ovarian eggs of the Volga sterlet, *Acipenser ruthenus*. This has been definitely established by the work of four investigators, extending in time from 1872 to 1922—a half century. Except in its earliest stages, *Polypodium* has the nutritive cell-layer of its stolon, the endoderm, on the outside bathed in the egg-yolk. Later this becomes inverted and a large amount of yolk is carried into the common cavity. The egg is used up in nourishing the parasite.

7. True parasitism has been shown between *Hydrichthys boycei* and numerous individuals of three species of fishes—*Ambassis natalensis*, *Mugil* sp., and an undetermined fish belonging to the Glyphidodontidæ—in Durban Bay, South Africa. The parasites were attached to various parts of the

fishes, especially the fins. At the points of attachment, haustoria were sent down into flesh and into blood-vessels, and by means of these the parasite fed on the tissues of its host. Furthermore, on none of the hydranths were tentacles ever found, nor was any food ever found in them. Strange to say, the parasite never covers any large area of the fish, and apparently presently drops off leaving a scar behind.

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EXPLANATION OF THE PLATES.

PLATE I.

- Fig. 1. An Indian Scorpænoid fish, *Minous inermis*, with its coat of symbiotic polyps—*Stylactis minoi*. After Alcock, 1902.
- Fig. 3. *Minous inermis* heavily coated with *Stylactis minoi*, from Sagami Bay, east coast of Japan. After Stechow, 1911.
- Fig. 10. No. 1, tip of ovary of *Acipenser ruthenus* from the Volga showing eggs infected with the hydroid *Polypodium hydriforme*. Nos. 2 and 3, individual eggs showing the worm-like hydroid coiled around and in the yolk. No. 4, the hydroid taken from an egg and partly uncoiled—youngest stage. After Ussov, 1885.

PLATE II.

- Fig. 11. No. 5, stolon of *Polypodium* removed from egg and showing the well-developed club-shaped buds. No. 6, an enlarged drawing of a group of buds; the dark spots on the buds show the bases of the tentacles growing inside the bud. No. 7, a stolon with everted buds, the eversion having brought the tentacles to the outside. After Ussov, 1885.
- Fig. 13. Much enlarged vertical section of *Hydrichthys boycei* through a gonostyle (?):—*m.g.*, the basal plate and the tissues of the fish; *h.s.*, hydranth sucking blood; *ep.*, epidermis of fish; *h.o.*, haustorium; *s.*, scale; *l.s.*, lymph space; *ec.p.*, ectoderm pit; *d.t.*, dead connective tissue of fish; *my.*, mycelium of a fungus found in cœlenteron of a gonostyle. After Warren, 1916.

III.—Notes on the Bronteidæ [=Goldiidæ].

By F. R. COWPER REED, Sc.D., F.G.S.

It is generally recognised that by the strict rules of priority the name *Goldius*, De Koninck, 1841, should be substituted for the name *Bronteus*, Goldfuss, 1843, the latter having been given in place of the earlier name *Brontes*, Goldfuss, 1839, when its founder discovered that this was pre-occupied. But the name *Bronteus* is so firmly implanted in geological literature and is still so widely employed that the change seems undesirable and unnecessary, though Raymond (1, p. 5; 1 a, p. 720), Bassler (2, p. 558), and other American geologists have adopted the names *Goldius* and *Goldiidæ* for the genus and family respectively. Most English and European geologists still use the names *Bronteus* and Bronteidæ, and amongst the latest to do so is Warburg (3, p. 141). In Australia also the same custom mostly persists (25, 26, 27, 28).

Recently it has been proposed to make another change, the Richters (4, pp. 239–243; 4 a, p. 116) maintaining that Pusch's name *Scutellum* (5, p. 119; 5 a, t. xiv. fig. 5) has priority of all, having been applied in 1833 to the Devonian trilobite *S. costatum*, Pusch (= *Bronteus granulatus*, Goldf., pars, 1843). In addition to the confusion which would be introduced by such a change, there is a danger of the name being confounded with *Scutella*, Lamarck, 1816, a genus of Echinoids, and it is not proposed to follow the Richters' proposals, although Kegel (6, p. 22) has recently done so in describing the trilobites from the Lower Devonian near Giessen. But the retention here of the old widely used name *Bronteus* is more for the sake of convenience than a matter of principle.

According to Raymond (1 a, p. 720), there are three genera in the family Bronteidæ [Goldiidæ]—*Bronteus* [*Goldius*], Goldf., *Thysanopeltis*, Corda, and *Bronteopsis*, Nicholson & Etheridge. The name *Thysanopeltis*, however, has not been generally accepted in a generic or even subgeneric sense, the species attributed to it being usually put with *Bronteus*, Barrande (7, p. 843, pl. xlvii. figs. 6–12). Novak (8, p. 36, t. iii. figs. 10–16) did not recognise it, though Gurich (9, p. 151, t. xlvii. fig. 1) and Richter (10, p. 91) have more recently done so.

The genus *Bronteopsis* may possibly be referable to another family and is discussed below independently.

Bronteus itself is usually considered to form a remarkably homogeneous group of species and not to be capable of satisfactory subdivision, and to this opinion Clarke (11, p. 725) and most others have subscribed. But in nearly every case it has been the pygidium alone by which any system of classification has been attempted, and the characters of the head-shield and especially of the glabella have been neglected. The thorax is not generally available, most species having been founded on isolated pygidia or head-shields, but when it has been found there are differences present amongst

the species which indicate that it has also followed various lines of development.

The definition of the genus *Bronteus* given by Hall (12, p. xxvi) in 1888, which is much fuller than usual in palaeontological treatises, is as follows:—"Body broadly oval. Cephalon semicircular with sharp often somewhat produced genal angles. Glabella closely appressed to the cheeks, broad anteriorly and extending to the frontal margin. Lateral furrows indistinct or obsolete. The facial sutures begin on the posterior margin, and in front of the eyes run parallel to the margin of the glabella, being continuous on the frontal margin *. Eyes lunate, homocorneal, and situated somewhat posteriorly. Thorax slightly larger than the cephalon and composed of ten segments, which upon the pleuræ are simple and sharply pointed. Pygidium very large, depressed convex, parabolic in outline with a very short subtriangular axis. The pleuræ [=lateral lobes] bear 7 or 8 simple ribs arranged on each side of a larger median simple or compound rib."

This definition is not quite satisfactory or correct, for in *B. lunatus* and other Ordovician species there are only six ribs on each side of the median rib on the pygidium, and the pygidium may be either flattened or strongly convex as in *B. campanifer*. The glabella also does not always extend to the frontal margin (e. g., *B. planus*, Corda.

Barrande (7, 829-890; 7 a, pp. 121-137), who entered into a detailed description of many Bohemian species of the genus, gave a diffuse diagnosis of the generic characters, but pointed out the considerable variations in the pygidial and cephalic characters.

To certain features of the head-shield attention has recently been called by Henriksen (13, pp. 17, 18) in discussing the segmentation of the head of trilobites. The "marginal suture" which joins the anterior branches of the facial sutures and runs in front of the glabella separates in *B. planus*, Corda, a well-developed preglabellar area on the upper surface from the rostrum (=epistome), which is very large in most of the species and lies on the lower surface of the head-shield. But in *B. campanifer*, Beyr., the inflation of the glabella is excessive and it falls forward beyond the original border and extends to the limit of the epistome. The sutures bounding the epistome on each side and cutting it off from the doublure of the free-cheeks are regarded by Henriksen as the anterior continuations of the facial sutures, whereas Hall in his definition (quoted above) calls the "marginal suture" the "conjoint facial sutures," and does not regard it as a separate transverse suture or "splitting line."

Richter (10 a, pp. 97-101, figs. 25-28) has pointed out that there are two chief types of external form in the genus *Bronteus*, one of which is flattened and the other convex and swollen, and

* This is only correct if we regard the sutures bounding the epistome on each side to be independent structures, and not the anterior continuation of facial sutures as Henriksen (see below) maintains.

that differences in the characters of the head and pygidium are associated with these types, which represent two divergent attempts at solving the difficulty of strengthening and stiffening the body. The flattened type is exemplified by *B. palifer*, Beyr., in which the head and pygidium are extended more or less horizontally without any marked convexity, the glabella and pygidial axis are strongly furrowed, and there are strong radial ribs on the upper and lower surfaces of the pygidium. The other type is exemplified by *B. campanifer*, Beyr., in which the head and pygidium are strongly convex, each forming a uniform dome; the glabella and pygidial axis are devoid of furrows and the axial furrows of the latter are weak, while the radial ribs are scarcely marked and, indeed, often disappear towards the middle of the pygidium. Moreover, the shell is thin in the flattened forms but thick in the vaulted forms. The pygidial doublure also differs in the two types, in the flattened form it is broad and extends inwards almost to the axis, whereas in the vaulted type it is narrower and limited to the outer third. Richter ascribes the development of these two types of structure to adaptation to environment and to be functional in character, being different methods devised to meet similar (?) dangers, and both being directed to the strengthening of the body and carapace. The *palifer* type is represented by many species in Bohemia on all horizons from E to G, and in the Middle Devonian of the Eifel by such species as *B. costatus*, Pusch, but *B. alutaceus*, Goldf., possesses a greater tendency to convexity and the ribs are therefore less strong and the furrows reduced. In Scandinavia the *palifer* type seems to be only represented amongst the Silurian species. With regard to the subgenera of *Bronteus*, Richter considers the *palifer* type to be typical of *Goldius* [= *Bronteus* auctt.] and the subgeneric type is *G. flabellifer*. The *campanifer* type was termed *Paralejurus* by Corda, 1847, who united the species *dormitzeri* and *campanifer* under this name, but the latter species may be regarded as the subgenotype.

The question of subgeneric divisions and designations is, however, discussed later in the present paper.

The whole genus *Bronteus* [= *Goldius*], sens. ext., which has for its genotype, according to the Richters (4, pp. 239-243; 4 a, p. 117, t. vii. figs. 18-23), *Scutellum costatum*, Pusch [= *B. granulatus*, Goldf.] (though most authors, including Bassler (2, p. 558), have quoted *B. flabellifer*, Goldf.), is most abundantly developed and differentiated in the Devonian, but ranges up from the Ordovician. It occurs in Europe, Asia, Australia, and America.

The earliest British representatives are *B. craigensis*, Reed (14, p. 89, pl. xii. figs. 12, 13), and *B. grayi*, Reed (14, p. 90, pl. xii. fig. 14), both from the Stinchard Limestone (Lower Ordovician) of Girvan. *B. hibernicus*, Portl. (15, p. 270, pl. v. fig. 8 a, b), is an allied species from the Ordovician of Northern Ireland, and is closely related to *B. laticauda*, Wahl. (16, p. 34, t. iii. figs. 9-11; 3, p. 141, pl. iii. figs. 3-15), from Northern Europe

(Upper Ordovician). In none of the British species is the head-shield known, all the species being founded on pygidia. In North America we have the well-known *B. lunatus*, Billings (17, p. 188, fig. 187; 1*b*, p. 32, pl. i. fig. 8), of the Trenton period. In all these there are only six pairs of "ribs" and a single postaxial piece (which may or may not be furrowed) on the pygidium. The axis is always simple and not trilobed, but may have one or two rings on its anterior end. The pygidium of *B. lunatus* is very similar to that of *B. laticauda*, as Warburg (*op. cit.*) has remarked.

The only English Silurian species of the genus which has been described is *B. signatus*, Phill.* (18, p. 131, pl. lvii. fig. 255), from the Wenlock Limestone of Dudley. This is not the same as the later-established *B. signatus*, Goldf. (19, p. 550, t. v. fig. 4, t. vi. fig. 7), of the European Devonian, and, as Phillips's specific name has priority, another designation must be found for the Devonian form if it is separable from other species. Phillips's species was founded on a pygidium having a trilobed axis with two rings on it and seven "ribs" on each side of the median postaxial "rib," which is simple.

In the Girvan district there is the species *B. andersoni*, Nich. & Eth. (14, p. 87, pl. xiii. figs. 8-11), from beds equivalent to the Llandovery and Tarannon, which is completely known and has been described in detail. The pygidium has likewise seven pairs of "ribs" on each side of a median simple postaxial "rib," but the axis which is faintly trilobed shows signs of segmentation by 7-8 transverse wrinkles. This species has been recorded also by Toll (20, p. 39, t. iii. fig. 5) from the New Siberian Islands, but we may question his identification. The structure of the head-shield and the relations of this species will be discussed later. No other British Silurian member of the genus has been described.

In Europe the chief region in which the genus was developed in Silurian times is Bohemia, and Barrande has described many species from Etage E, which comprise several more or less distinct types of structure, though all of them have in the pygidium seven pairs of ribs on each side of a single or bifurcated median postaxial piece. Different types are represented by *B. planus*, Corda (7, p. 863, pl. xlii. figs. 34, 35, pl. xlviii. figs. 1-8), *B. haidingeri*, Barr. (7, p. 875, pl. xlvi. figs. 32-39), and *B. partschi*, Barr. (7, p. 870, pl. xlvi. figs. 19-31 [p. 23]).

In the Scandinavian region we have *B. platyactin*, Ang. (21, p. 57, t. xxxii. fig. 3; 22, p. 86, t. xiv. figs. 1-3, t. xvi. fig. 21); *B. polyactin*, Ang. (22, p. 87, t. xiv. figs. 4-6); *B. irradians*, Lindstr. (22, p. 88, t. xiv. fig. 7); *B. umbonatus*, Lindstr. (22, p. 89, t. xiv. figs. 15, 16); *B. crebristriatus*, Lindstr. (22, p. 89, t. xvi. figs. 22, 23); *B. estonicus*, Schmidt (16, p. 36, t. iii. figs. 1-7); and *B. marklini*, Ang. (16, p. 38, t. iii. fig. 8). All of these have seven pairs of ribs on each side of the postaxial rib of the pygidium.

* Woodward in 1877, Cat. Brit. Foss. Crust. Brit. Mus. p. 147, erroneously referred this species to *B. laticauda*.

In America several species are known from the Niagaran and Clinton formations, and Bassler (2, p. 559) records the following:—

<i>Bronteus</i>	[<i>Goldius</i>]	<i>acamas</i> (Hall), Niagaran.
—	[—]	<i>aquilonaris</i> (Whiteaves), Niagaran.
—	[—]	<i>ekwanensis</i> (Whiteaves), Niagaran.
—	[—]	<i>flabellifer</i> (Goldf.) [?], Niagaran.
—	[—]	<i>laphumi</i> (Whitfield), Niagaran.
—	[—]	<i>occusus</i> (Winchell & Marcy), Niagaran.
—	[—]	<i>niagarensis</i> (Hall), Clinton.

We may much doubt if the above-quoted *B. flabellifer*, Goldf., from Arctic America, was rightly identified by Etheridge (23, p. 590), as it is typically a Devonian species.

All of the above American species from Silurian beds have seven pairs of "ribs" on the lateral lobes of the pygidium and one median postaxial rib.

The Canadian species in the foregoing list are *B. ekwanensis* (24, p. 266, pl. xlii. fig. 1) and *B. aquilonaris* (24, p. 267, pl. xlii. fig. 2). The median rib in *B. niagarensis* and *B. acamas* is simple, single and undivided, but in the two Canadian forms it is weakly bifurcated posteriorly.

A considerable number of species of *Bronteus* have been described from the Australian Silurian (25, pp. 499–503, pl. xxvi. figs. 6–10), but some may be from Hercynian horizons. Most of them are based on pygidia, and the most completely known species is *B. jenkinsi*, Eth. & Mitch. (26, p. 501, pl. xviii. figs. 1–7). One of the species, *B. molongensis*, Eth. & Mitch. (26, p. 501, pl. xxvi. fig. 8), from doubtful "Upper" Silurian beds in New South Wales, is described as having a trilobed axis, a bifurcated median "rib" on the pygidium, and seven "ribs" on each side. But it is said that there are only six "ribs" and a simple tumid axis in *B. angusticaudatus*, Eth. & Mitch. (26, p. 502, pl. xxvi. figs. 9, 10). If there are truly only six ribs, it is a remarkable exception. The figure of *B. bowningensis*, Eth. & Mitch. (26, p. 500, pl. xxvi. fig. 6), shows seven "ribs" on each side, though the authors state there are only four. *B. mesembrinus*, Eth. & Mitch. (26, p. 500, pl. xxvi. fig. 7), has seven "ribs" on each side of the single median "rib," and the axis is simple, whereas in *B. bowningensis*, as well as in *B. molongensis*, the axis is trilobed. Mitchell (27, p. 53, pl. x. fig. 9) has more recently described another new species from the Silurian of New South Wales under the name *B. platynotus*, which has a broad trilobed axis and seven pairs of "ribs" on each side of the median rib.

B. [G.] greeni, Chapman (28, p. 159, pl. xiv. figs. 1, 2), which is allied to the Scotch *B. andersoni*, Nich. & Eth., has seven pairs of "ribs" and a bifurcated median one, while *B. [G.] cresswelli*, Chapman (28, p. 160, pl. xiv. fig. 3, pl. xvi. fig. 17), is said to have 6–7 pairs of ribs and a median rib partly bifurcated or furrowed.

We may therefore state with considerable confidence that all the Silurian species from whatever region possess the seven pairs of "ribs" on the pygidium and a median postaxial piece or "rib," which may or may not be bifurcated. In this respect they differ from the Ordovician species, which have only six pairs of "ribs" and a median piece.

According to Raymond (1 c, p. 22; 1 d, p. 68), the study of both the morphology and ontogeny of trilobites shows that the large pygidium in this group is a primitive feature, while a small pygidium indicates specialisation: for new segments are pushed off from the anterior end of the pygidium, and the thorax grows thereby, while the pygidium decreases in size and in its number of segments. The pygidium is, moreover, not to be regarded as built up by the fusion of free segments. If we adopt Raymond's interpretation of the structure, it would seem that we must conclude that, in the geologically later members of the genus *Bronteus*, the presence of a greater number of pygidial "pleuræ" indicates that the newly formed pygidial segments have not been separated from the anterior end to join the thorax, but have remained attached to it so as to increase the size of the pygidium, which thereby would form a more powerful swimming-organ or caudal fin, as Raymond remarks.

As before mentioned, it is in the Devonian that the majority of species of the genus have been found, and it is especially in the Hercynian fauna that the genus is greatly developed. Barrande has described a large number of species of various types, which may be assembled in several groups, such as *B. palifer*, Beyr., *B. umbellifer*, Beyr., *B. campanifer*, Beyr., and *B. rhinoceros*, Barr., to which special reference is made below. The Bohemian species possess a considerable range of differences, and accordingly may be allocated to several distinct groups on the strength of features exhibited by the pygidium as well as by the glabella. But all of them have seven "ribs" on each side of the median postaxial piece of the pygidium, though this postaxial piece may be either simple or bifurcated.

In France several species belonging to the Hercynian fauna have been described, such as *B. verneuili*, Oehl. & Dav., and *B. galloisi*, Oehl., both of which belong to the same group of species as *B. campanifer*, Beyr. (see below), but *B. gervillei*, Barr., from the Devonian of Normandy is allied to *B. umbellifer*.

In the Middle and Upper Devonian of Northern and Central Europe the genus is represented by many species, such as *B. flabellifer*, Goldf., *B. costatus*, Pusch, and *B. scaber*, Goldf.; and from Central Asia and Siberia Tschernyschew, Von Peetz, and others have described several more (see below). But the synonymy of the European species is a matter of controversy, and the well-known specific names are used in different senses by different authors. For instance, Goldfuss (19, p. 549) described seven Devonian species of *Bronteus* in 1843, but, according to the Richters (4, pp. 239-243), they may all be comprised in the following four species:—

B. costatus (Pusch), 1833 (= *granulatus*, Goldf.); *B. alutaceus*, Goldf., 1843; *B. flabellifer*, Goldf., 1839; and *B. scaber*, Goldf., 1843.

Whidborne (29, pp. 32-42, pl. iii.) recognised all the above species (except *B. scaber*) in the British Middle Devonian beds, terming *B. costatus* (Pusch) *B. granulatus*, Goldf., as is the usual custom; and, in addition, he established three new species which he named respectively *B. delicatus*, *B. tigrinus*, and *B. pardalios*, but most of them are imperfectly known, and Whidborne's *B. flabellifer* is not the same as that of Goldfuss or Richter.

In North America we have *B. senescens*, Clarke (11 a, p. 734, figs. 3, 4), from the Chemung formation, and *B. tullius*, Hall & Clarke (12, p. 12, pl. viii. A, figs. 34-36), from the Tully Limestone, both of which, according to the Richters (4 a, p. 124), are allied to *B. costatus* (Pusch).

All the Devonian species (except *B. radiatus*, Munst.) have seven pairs of ribs on the pygidium and a median simple, grooved, or bifurcated rib, but there is considerable diversity of development of the several characters, and, though Barrande on the strength of the possession of the same number of pygidial ribs associated them with the Silurian representatives of the genus in his system of grouping, we shall see that other morphological features must be taken into account to arrive at a natural classification.

CLASSIFICATION.

Corda (30, pp. 58, 59) proposed to classify the species of *Bronteus* partly on the basis of the simplicity or duplication of the median "rib" on the pygidium, suggesting for the simple-ribbed forms the subgeneric or generic name *Holomeris* and for the bifurcated ribbed forms the name *Dicranactis*. But Barrande (7, p. 838) pointed out that the bifurcation of the median rib in certain species (e. g., *B. haidingeri*) is only a question of age, so that this principle of classification is of little value. The third division, *Paralejurus*, which Corda proposed, was to comprise those species devoid of an axis and of ribs in the central part of the pygidium. But it was based on worn and badly preserved specimens, and these apparent characters were only due to their imperfect condition, so that its value has been discounted, though Richter (10 a, p. 98, footnote) would revive it as a subgenus.

Barrande (7, pp. 840, 841) considered that all the known species of *Bronteus* could be grouped according to the number of paired ribs on the pygidium, and on this principle he recognised three main groups having respectively six, seven, or eight pairs, those with seven pairs comprising all the Bohemian species from all horizons. A subordinate division of the group with seven pairs was based on the ornamentation of the shell. The posterior single median unpaired rib or postaxial piece, which may be simple or grooved or distally bifurcated, was not regarded as of value in his scheme. But its character cannot be thus easily dismissed. It has been sometimes thought that this unpaired median piece was not an

original single median postaxial piece (such as we find in *Lichas* and its subgenera), but as composed of a pair of pleuræ which have either become wholly or partially fused, if we regard its simplicity to be of secondary origin, or as composed of an imperfectly separated pair of pleuræ if we regard the fission or duplication as secondary. Its duplicated nature is indicated in some species merely by a median furrow of greater or less extent and strength, but in many by a definite distal bifurcation. In others the median piece shows no trace of a compound nature. The fact that the division or bifurcation may be only acquired by mature individuals, while young specimens of the same species possess a simple undivided postaxial piece, was pointed out long ago by Barrande, and *B. dormitzeri* furnishes an example of this modification due to age. Such a feature in the course of the development of the individual proves that there is an ontogenetic element in the condition of the median rib or postaxial piece, and suggests that the change may likewise be traceable in the phylogeny. If we regard the older part of the pygidium to be the posterior end, this part would be expected to possess more primitive characters in the early representatives of the genus and to show more modification in the later members, for it must have been longer subject to variation than the anterior part. On this supposition, the splitting open or bifurcation of the postaxial piece would be looked upon as a secondary change during the later history of the genus, and in confirmation of this view we find that the bifurcation is most completely developed in the later members and especially in the Devonian species. A general modification of the other constituent parts of the pygidium seems to have accompanied generally that of the postaxial piece, for its bifurcation is most definite and complete in those species in which the ribs have suffered most alteration, such as is indicated by their reduction to narrow radiating ridges separated by wide interpleural grooves on the upper surface which rise into ribs on the lower (inner) surface of the pygidium. We see this ultimate condition in the Devonian species *B. speciosus* (Corda) (= *thysanopeltis*, Barr.), which also shows its specialization in other ways, such as the development of a marginal fringe of spines (see below), a feature sometimes regarded as indicating a separate genus.

The interpretation of the composition and structure of the pygidium of *Bronteus*, which was suggested by Beyrich (31, p. 34) in 1845, has not been generally adopted, though there is much to recommend it, and Richter (10 b, p. 115, text-figs.) has recently suggested a similar principle of interpretation in the case of the Proetidæ. According to Beyrich, only half of the furrows on the lateral lobes are interpleural, the others being pleural; for he held that, as in certain species of *Lichas*, each complete pleura possessed a true pleural furrow on its surface. Thus in the Bronteid pygidium only the second, fourth, and sixth furrows were regarded as interpleural and considered to define three complete pleuræ, the intermediate furrows (first, third, and fifth) being only pleural. The absence of rings on the pygidial axis in most cases makes it

difficult to prove that this interpretation is correct, for we cannot see to what extent the axial segments and pleuræ correspond.

There is not, moreover, usually sufficient difference (if any) in the character, course, and length of the furrows on the lateral lobes of most species of *Bronteus* to enable us to distinguish pleural and interpleural furrows. But if we carefully study the pygidium of the Ordovician species *B. laticauda*, Wahl. (3, pl. iii. figs. 3, 6, 11, 12), one of the earliest and best-known representatives of the genus, we can without much difficulty recognize in it two kinds of furrows. Warburg's figures show that the first, third, and fifth furrows are shorter than the others, particularly the first one, and and that they may be regarded as true pleural furrows.

The composition and structure of the pygidium of this species, if interpreted in this manner, is remarkably similar to that of *Lichas* and of its subgenera. Indeed, the understanding of the structure of the pygidium of all the species of *Bronteus* is rendered easier on the supposition that there are only three (or four) pairs of pleuræ composing it, each possessing a median pleural furrow, and this view

Fig. 1.



Bronteus laticauda.

brings the structure more into consonance with that of other trilobites. Each "rib" would on this principle correspond to half a pleura, and it follows that with this interpretation of the pygidium the ribs and pleuræ of the Bronteid pygidium are not interchangeable terms.

Warburg (3, p. 145) objected to this view that furrowed pygidial pleuræ composed the pygidium, on the ground that the thoracic pleuræ of *Bronteus* are devoid of furrows. But too much weight need not be attached to this apparently important objection, for in *B. edwardsi*, Barr. (7, p. 882, pl. xlii. fig. 32), from Stage E, if not in other species, pleural furrows are present in the thorax. It may also be remarked that in many families and genera of trilobites there is no close similarity between the pleuræ of the pygidium and of the thorax.

Another objection which has been raised depends on too great a reliance on the resemblance of the pygidia of *Bronteus* and *Bronteopsis*, but the pygidium of the latter is much more like that of *Stygina* than of *Bronteus*, as the present author and Raymond

(1 e, pp. 68-71) have pointed out, and we are not convinced that *Bronteopsis* belongs to the family Bronteidæ (see sequel). On the whole, if we believe that the earlier species of *Bronteus* represent and exhibit more primitive characters and a less modified structure, it appears that we may regard with favour Beyrich's view of the composition of the pygidium, in spite of Barrande's arguments against it and in spite of the usual interpretation adopted by the majority of palæontologists. The analogy, if not homology, of the pygidium of certain species of *Lichas* supports Beyrich's view. Thus, if we study the figures given by Warburg (3, p. 302, pl. viii. figs. 1-8, 11-13) of *Lichas affinis*, Ang., and *L. luciniatus*, Wahl (3, p. 295, pl. viii. figs. 14-20), we cannot fail to see how close a resemblance exists between the development of the pleuræ and furrows on the pygidium of these species and that of the "ribs" on the pygidium of almost any Silurian species of *Bronteus*, and how it is explicable on the supposition that only half of the furrows in the latter are of interpleural origin. Apart from the ends of the pleuræ in *Lichas* being free, which is a feature of minor importance in this connection, since they have almost disappeared in such species as *L. maia*, Reed (14 a, p. 219, text-fig. p. 222), the similarity is strikingly close.

But the problem of the nature of the median unpaired postaxial piece or "rib" remains to be considered. We shall see that this piece is best regarded as being of a composite nature and consisting of an undifferentiated fused pair of pleuræ, which at this early stage have not separated from each other and even have not had the median interpleural furrow developed. In the more specialised and later species the separation may be so far effected as to lead to the divergence of the distal ends of the pleuræ.

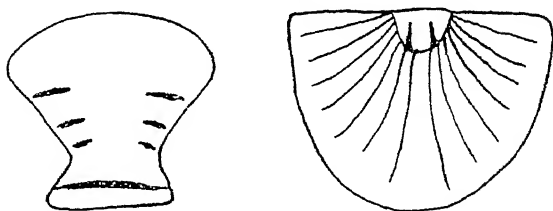
On the assumption that this interpretation of the structure of the pygidium of *Bronteus* is valid, it is necessary to regard the Ordovician species as constituting a group possessing three pairs of furrowed pleuræ (*i. e.*, six lateral "ribs") and a single median postaxial piece, making thirteen ribs in all. These are the earliest representatives of the genus, and the characters of the pygidium alone are sufficient to suggest their subgeneric separation under a new name (*Eobronteus*, nom. prop.).

In the case of the Silurian and Devonian species of *Bronteus*, in which the pygidium has always * seven "ribs" on each side of a

* Woodward (Geol. Mag. v. vol. vii. 1910, p. 409) followed Barrande in stating that *B. radiatus*, Münst., is said to have eight, but the author has not found this statement confirmed and has not been able to examine an example of this species. Etheridge and Mitchell (Proc. Linn. Soc. N.S. Wales, vol. xlii. 1917, pt. 3, p. 502, pl. xxvi. figs. 9, 10) state that their Silurian species, *B. angusticaudatus* from New South Wales, has only six ribs on each side of the postaxial piece, and also that there are only four on each side in the species *B. bowningensis* (op. cit. p. 501, pl. xxvi. fig. 6), though their figure clearly shows seven. These statements therefore are hardly satisfactory or sufficiently supported to upset the present author's conclusions, and it may be pointed out that in *B. rhinoceros*, Barr., the bifurcation of the postaxial piece is carried so far that there are practically eight pairs of ribs.

single postaxial piece which may or may not be furrowed or bifurcated, we are faced with an apparent difficulty. But it allows of more than one solution. It seems that we can best explain it on the view that the original composite postaxial piece has commenced its development into a pair of independent pleuræ by only splitting off the outer half of each pleura, while the inner portions of the pleuræ (*i. e.*, the half pleuræ) posterior to and inside the pleural furrows still remain fused together in the middle line, thus forming again a single new and narrower median postaxial piece; the two outer and separated halves of this fourth pair of pleuræ have become the seventh pair of "ribs" of the pygidium. The separation of the inner halves of this pair of pleuræ by the development of an interpleural furrow between them is seen to have begun in other species and to have reached a more or less advanced stage, the postaxial piece showing a longer or shorter median groove (=interpleural furrow); or the separation may be indicated by a posterior bifurcation of this piece resulting from a divergence of the tips of the pleuræ composing it. A similar increase of pleuræ or half-pleuræ

Fig. 2 a.

*Bronteus planus.*

on the lateral lobes of the pygidium is known to take place in species of *Asaphus*, *Ogygia*, *Barrandia*, etc., without causing any fundamental alteration of structure or making us doubtful of its origin or of the homology of the parts.

The degree of bifurcation of the postaxial piece varies in different species, but it is specially marked in some Hercynian and later Devonian forms (e. g., *B. speciosus*, Corda, *B. rhinoceros*, Barr.), though it is clearly developed in the Silurian *B. haidingeri*. Barrande (7, pp. 841-890; 7 a, pp. 121-137) has described a large number of slightly different but related types from the Hercynian of Bohemia, showing stages in specialisation or degeneration of the pygidial pleuræ.

Thus *B. rhinoceros* has such a deeply bifurcated postaxial piece as practically to result in the production of eight pairs of ribs instead of seven, and the ribs also end against a more or less definite border, which is another specialised development frequently met with in other Devonian species, such as *B. speciosus* (see below).

In the *B. palifer* group of species the bifurcation is less

developed, and the same remark applies to the *B. umbellifer* group.

The least-developed bifurcation is in the *B. campanifer* group, in which the convexity of the whole trilobite seems to be connected with the loss of segmental structures, the furrows being faint and nearly obsolete, and such is characteristic of this type of the genus. The higher Devonian species, such as those present in the Middle Devonian of Europe, may have the median "rib" simple, as in *B. pardalios*, Whidb. (29, p. 35, pl. iii. figs. 1-7), and the furrows separating all the "ribs" narrow, which seems to be a primitive character. But in *B. costatus*, Pusch, the furrows have become wider between the ribs, and the latter are more prominent.

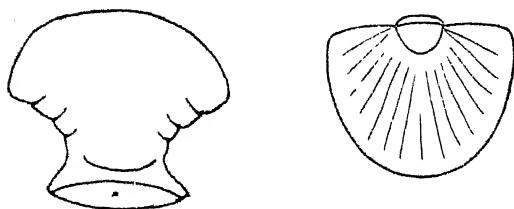
The most extreme form of specialisation is met with in

Fig. 2 b.



Bronteus hardingeri.

Fig. 2 c.



Bronteus campanifer.

B. speciosus (= *thysanopeltis*) (42, pp. 474-477), in which the "ribs" are reduced to narrow prominent ridges and the furrows between them have become wide sunken interspaces; the postaxial piece is bifurcated into a semifused pair of similar narrow ribs, and a border armed with spines surrounds the whole (see below).

Apart from the segmentation of the lateral lobes the character of the axis needs some notice, though but little attention has been paid to it; for it may be trilobed or simply conical, smooth and devoid of segmentation, or provided with several rings.

Whether these characters are correlated with the number of the ribs or the flatness of the lateral lobes is a matter which calls for some remarks.

In the Ordovician species the axis is always simple, but may

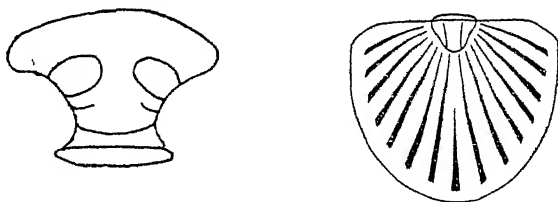
have one or two rings upon it. In the Silurian species which have seven "ribs" on each side of the postaxial piece the axis may be simple and conical or may be longitudinally trilobed, and in a few cases it shows signs of segmentation. In *B. andersoni*, Nich. & Eth., the axis is faintly trilobed and shows signs of 7-8 transverse wrinkles (rings?) upon it. *B. signatus*, Phil., has a trilobed axis with two well-marked rings at its front end.

In the Bohemian species from Stage E the trilobation of the axis is general, and in *B. planus*, Corda (7, p. 863, pl. xlii. figs. 34, 35, pl. xlviii. figs. 1-8), traces of segmentation similar to that in *B. andersoni* are apparent. But in the Baltic *B. estonicus*, Schmidt (16, p. 36, t. iii. figs. 1-7), the axis is simple and not trilobed.

The two Canadian species of *Bronteus* from the Silurian (*B. ekwanensis*, Whiteaves (24, p. 266, pl. xlii. fig. 1), and *B. aquilonaris*, Whiteaves (24, p. 267, pl. xlii. fig. 2)) have also a simple non-segmented and non-trilobed axis.

The American species, *B. acamas*, Hall, and *B. niagarensis*, Hall, likewise, have a simple axis.

Fig. 2 d.

*Bronteus palifer.*

Amongst the many Australian species of *Bronteus* occurring in the Silurian most of them have a trilobed axis (*B. bowningensis*, Eth. & Mitch. (25, p. 501, pl. xxvi. fig. 6), *B. molongensis*, Eth. & Mitch. (25, p. 501, pl. xxvi. fig. 8), *B. greeni*, Chapman (28, p. 159, pl. xiv. figs. 1, 2), *B. platynotus*, Mitch. (27, p. 53, pl. x. fig. 9)), while others (*B. jenkinsi*, Eth. (26, p. 501, pl. xviii. figs. 1-7), *B. cresswelli*, Chapman (28, p. 160, pl. xiv. fig. 3, pl. xvi. fig. 17), *B. mesembrinus*, Eth. & Mitch. (25, p. 500, pl. xxvi. fig. 7), *B. angusticaudatus*, Eth. & Mitch. (25, p. 502, pl. xxvi. figs. 9, 10)) have a simple conical axis, though *B. jenkinsi* has 7-8 obscure wrinkles across it like the Scottish *B. andersoni*, and *B. greeni* shows seven segments on the middle lobe of the axis. In all of these (? except *B. angusticaudatus*) there are the usual seven "ribs" on each side of a median postaxial piece which may be simple (*B. jenkinsi*, *B. mesembrinus*) or bifurcated (*B. molongensis*, *B. greeni*).

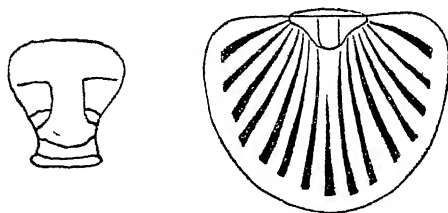
In the case of the Bohemian species of *Bronteus* from the Hercynian stages F and G we find the axis trilobed in the groups

represented by the species *B. furcifer*, Corda (7, p. 858, pl. xlviii. figs. 36-38; 7 a, p. 126, pl. xi. figs. 12-18), *B. palifer*, Beyr. (7, p. 859, pl. viii. fig. 31, pl. xlv. figs. 1-21; 7 a, p. 129, pl. xvi. figs. 21, 22), and *B. umbellifer*, Beyr. (7, p. 879, pl. xlv. figs. 13-24, pl. xlviii. figs. 28-30; 7 a, p. 137, pl. xvi. figs. 23, 24). In *B. campanifer*, Beyr. (7, p. 844, pl. xlv. figs. 1-12), and its allies the axis is simple and not trilobed.

In the Lower Devonian of New York we find *B. barrandii*, Hall (11 b, p. 104, pl. ix. figs. 12, 13) (non *B. barrandei*, Hébert), with a pygidium having a simple axis, but in the figure of its variety *major*, Clarke (11 c, p. 18, pl. i. fig. 7), a weak trilobation of the axis is shown.

In the Middle and Upper Devonian species of *Bronteus* occurring in Europe the axis is often simple and shows no trilobation—e. g., *B. pardalios*, Whidb. (29, p. 35, pl. iii. figs. 1-7), *B. flabellifer*, Goldf. (19, p. 549, t. vi. fig. 3), *B. alutaceus*, Goldf. (19, t. vi. fig. 1), *B. granulatus*, Goldf. (19, t. vi. fig. 2; 32, p. 13, t. xiii. figs. 5-10, t. xvi. fig. 18; 33, p. 483, t. xxiv. fig. 7). But in

Fig. 2 e.

*Bronteus umbellifer*.

B. intermedius, Goldf. (19, t. vi. fig. 4), and *B. scaber*, Goldf. (19, t. vi. fig. 5), the trilobation is marked. [The Richters' (4, pp. 239-243) synonymy of these species is not here adopted.] In the American *B. senescens*, Clarke (11 a, p. 734, figs. 3, 4), from the Upper Devonian, the axis is faintly trilobed.

From the above evidence it does not seem that the trilobation of the axis is associated with a special type of pygidium, or is of primary importance.

The degree of distinctness with which the "ribs" on the pygidium in the species from all horizons are marked and the length and strength of the interpleural and pleural furrows vary considerably. In some cases the "ribs" are defined to the margin of the pygidium; in others (e. g., *B. campanifer*) the dividing furrows are mere thin lines and die out at some distance from the edge, while in others they become wide grooves (*B. haidingeri*, *B. palifer*, etc.) and have quite lost their original character, being nearly or quite as wide as the "ribs." This latter condition is most marked in some of the Devonian species, such as members of the section or

subgenus *Thysanopeltis*, and it indicates an extreme modification. Richter (10 a, p. 97, fig. 25) believes that this kind of ribbing is part of the effort to strengthen the thin flattened pygidium of these forus and is probably correlated with their mode of life. Intermediate stages may be recognised in some species, such as in *B. costatus*, Pusch, *B. umbellifer*, Beyr., *B. formosus*, Barr., etc. The development of a regular border forming a marginal raised band against which the ribs end abruptly is most marked in the later Devonian species, though some Hercynian forms show its inception.

There are other features in the structure and characters of the pygidium which must be taken into account in any attempt at classification. Such is the degree of flatness or convexity of this part of the body. But, as above stated, Richter believes that the flattened form which is provided with radial struts and has a thin shell, such as in *B. palifer*, Beyr., and others of its type, is an adaptive modification merely designed for increasing the strength of this member, the same object being attained in *B. campanifer* and others of its type by means of the convexity and thickness of the shell. He would therefore regard these differences as functional adaptations and of no phylogenetic or stratigraphical significance (10 c, p. 44), though in an earlier paper (10 a, p. 98) he suggested the revival of Corda's name *Paralejurus* for the *B. campanifer* group of species to be used in a subgeneric sense.

The ornamentation of the shell to which Barrande attached considerable importance in his scheme of classification is undoubtedly only of minor and superficial value except for purposes of specific distinction.

The peculiar elongated narrow type of pygidium, which is found in *B. perlongus*, Barr. (7 a, p. 129, pl. xv. figs. 36, 37), and *B. scharzi*, Barr. (7 a, p. 132, pl. ix. figs. 5-8), of the Hercynian of Bohemia, has most of the characteristics of the allied *palifer* or *umbellifer* groups, and may be held to constitute only a subgroup of one of them.

From the foregoing considerations we are led to see a possible grouping of the species of *Bronteus* into two main divisions on the strength of the pygidial characters:—

(1) Species with pygidium composed of three separate pairs of complete furrowed pleuræ, forming six pairs of ribs, and of a single median simple or faintly grooved postaxial piece composed of a fourth pair of fused pleuræ. This group is wholly Ordovician and exhibits a condition parallel to that found in *Lichas* (*Lichas*).

(2) Species with pygidium composed of three separate pairs of completely furrowed pleuræ forming six pairs of ribs, and of a seventh pair consisting of the anterior half of the fourth pair of pleuræ; the posterior halves of this pair may be (a) completely fused in the middle line forming a simple postaxial piece, or (b) may be partly separated by the development of the interpleural furrow between this pair of pleuræ, as shown by a median groove on the postaxial piece, or (c) may have their distal ends divergent, by

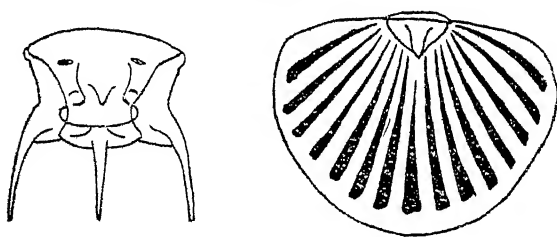
the posterior bifurcation of the postaxial piece, so that an eighth pair of ribs begins to be formed.

Seven "ribs" or half-pleuræ are thus present on each side of the median line in all these conditions, and an eighth pair of ribs is beginning to be developed in section *c*. This last stage (*c*) of group 2 indicates the final attempt at the separation of the fourth pair of the pleuræ of the lateral lobes of the pygidium, and is chiefly found in the Devonian members of the genus.

It appears that this interpretation of the structure of the pygidium is in accordance with the theory that the posterior part of the pygidium is the most modified, being the oldest, for (as we should expect on this principle) we find that the Devonian forms show the widest departure in structure from the primitive or earliest species, the fused fourth pair of pleuræ becoming more and more differentiated and separated in the later stratigraphical stages, and the ribs in the rest of the pygidium being scarcely recognisable as half-pleuræ.

The most complete separation of the fourth pair of pleuræ,

Fig. 2 f.



Bronteus rhinoceros.

resulting in the development of an eighth pair of ribs, is found in the aberrant species *B. rhinoceros*, Barr.

But in any adequate determination of the affinities and grouping of the species we must pay attention to the cephalic and thoracic as well as the pygidial characters, though, as above pointed out, Barrande did not do so, for he based his classification entirely on the number of "ribs" in the pygidium, in spite of having to deal with a very varied lot of species of the genus occurring on many different Silurian and Devonian horizons.

With regard to the thorax we are unfortunately in most cases ignorant of its character, the species of *Bronteus* being mostly founded on isolated head-shields or pygidia. But when complete individuals are known, such as *B. lunatus*, Bill., *B. andersoni*, Nich. & Eth., *B. edwardsi*, Barr., *B. brongniarti*, Barr., *B. partschi*, Barr., *B. haidingeri*, Barr., *B. porosus*, Barr., *B. umbellifer*, Beyr., *B. speciosus*, Beyr., and others, we see several differences of structure, some of which Barrande (7, p. 834) noticed.

In *B. lunatus* the pleuræ form simple flat bands of regular width in contact nearly to their tips and are without pleural furrows. The same characters are found in the Silurian *B. andersoni*. In *B. laticauda* (3, p. 143, pl. iii. fig. 9) the ends of the pleuræ are free, and there are narrow articulating marginal bands along the greater part of the pleuræ, which show no constriction; the surface of the pleuræ is flattened and unfurrowed as in *B. lunatus*.

In *B. edwardsi*, Barr. (7, p. 882, pl. xlii. figs. 30-33), and *B. porosus*, Barr. (7, p. 885, pl. xlv. figs. 15-18, pl. xlviii. figs. 23-26), there is a median pleural furrow which Barrande terms the "accessory furrow," for in the other species of the genus the pleuræ are unfurrowed, though we can detect a trace of furrows in internal casts of *B. palifer*, Beyr. There is generally a narrow band along part of the length of each edge of the pleura, but in *B. edwardsi* it seems to be absent, while in many of the Hercynian and all the later Devonian species it extends only along half of the pleura and at the place where it ends there is a marked constriction; the outer part of the pleura is also more or less free and of the nature of a spine.

In *B. planus*, Corda, from Stage E, the constriction is scarcely marked, but the marginal bands are long, and the association with this type of thorax of a glabella having simple lobation with a pre-glabellar area and of a pygidium with broad ribs, narrow interpleural furrows, and a simple postaxial piece indicates that this species is more primitive and less specialised than those from Stages F and G.

In most of the species from Stage E the pleuræ lie close to each other for their whole length, and the outer part beyond the marginal bands does not form a free spine. We see a good example of this in *B. partschi*, Barr. (7, p. 870, pl. xlv. figs. 19-31). Others, however, from Stage E, such as *B. hardingeri*, Barr. (7, p. 875, pl. xlv. figs. 32-39), show a marked constriction at the place where the marginal band ends, and the outer part of the pleura is free. This condition is also found in most Hercynian species, though the constriction is usually more evident, e.g., *B. umbellifer*, Beyr., *B. formosus*, Barr. (7, p. 851, pl. xlv. fig. 14, pl. xlvii. figs. 1-5), etc. The reduction in the length of the marginal bands results in the greater length of the free spinose ends, and this is seen in the *campanifer* group (e.g., *B. brongniarti*, Barr. (7, 866, pl. xlv. figs. 1-12), from Stages F and G). It is surprising to find a pleural furrow in the somewhat specialised species *B. porosus*, Barr. (7, p. 885, pl. xlv. figs. 15-18, pl. xlviii. figs. 23-26), from Stage G, for it has well-constricted pleuræ and a head-shield (see below) of a character indicating that it belongs to the *umbellifer* group, of which it seems a late type.

With regard to the cephalic characters there is considerable diversity in the lobation of the glabella, which, however, has rarely been used for classificatory purposes.

The identification of the lateral furrows on the glabella is difficult because of their generally peculiar development, and we cannot always feel sure of their correlation with those in other genera, such as *Phacops* or *Cheirurus*. In *Ogygia* (*Ogygites*) and *Barrandia* we find much the same problem in interpreting and correlating the glabellar furrows. Barrande (7, p. 833) based his interpretation and correlation of these furrows on their development in the Silurian species *B. planus*, Corda (7, p. 863, pl. xlii. figs. 34, 35), and in the Hercynian *B. palifer*, Beyr. (7, p. 859, pl. xlv. figs. 1-21), both occurring in Bohemia. In these species each of the furrows is isolated and nearly transverse. Generally the middle (second) lateral furrow starting from the axial furrow crosses transversely or obliquely as much as a quarter of the width of the glabella, and then bends up parallel to the axis to unite with the anterior (first) furrow. The anterior furrow is transverse and never more than one-fourth the width of the glabella and is sometimes isolated from the axial furrow, the inner end being also deeper. The third (posterior) furrow is short and always unites with the second furrow; the basal lobe is never well defined. The first lobe is always the largest and the second lobe may be reduced to a mere tubercle.

Wedekind (34, p. 74) attempted a partial classification of the species of the genus by means of the glabellar characters, recognising three groups. The first, typified by *B. planus*, Corda, is characterised by having all three lateral furrows parallel to the base of the head-shield; the middle glabellar lobe is short, and the frontal and anterior lobes are high. The second, typified by *B. umbellifer*, Beyr., has the anterior lateral furrows parallel to the base of the head-shield, but the posterior and middle lateral furrows are bent forward and connected with the anterior furrow; the middle lobe is small and nodular. In the third group, which is typified by *B. brevifrons*, Barr. (7, p. 886, pl. xlv. figs. 25-29), the posterior and middle furrows are united as in the second group, but their continuations forward do not run parallel to the axial line, being convergent anteriorly to about the middle of the front border of the head-shield.

This system of grouping the species was apparently based only on Bohemian types, but it is founded on sound principles, and the present author had established two of these well-marked groups (*B. planus* and *B. umbellifer*) before he was acquainted with Wedekind's paper. The third group does not seem so distinct, and *B. brevifrons* seems inseparable from the *umbellifer* group.

In the earliest (Ordovician) group of *Bronteus* the question of determining and correlating the lateral and other furrows on the glabella is usually fairly simple, though the first, second, and third furrows are only represented by isolated short grooves or transverse pits, as in *B. lunatus*, Billings (1 b, p. 32, pl. ix. fig. 8; 2, p. 559), and *B. laticauda*, Wahl., and the lateral lobes are not completely defined.

The head-shield in *B. laticauda* is well described and figured by

Warburg (*op. cit.*), but is not precisely similar in detail to the American species *B. lunatus*. The glabella has three pairs of short lateral furrows in both species, and in both they tend to be of a pit-like character. The lateral lobes are thus very indistinctly defined. The central part of the base of the neck of the glabella tends to be swollen, and the meso-occipital furrow is nearly straight. The small "para-glabellar area" on the axial furrow on each side which lies inside the palpebral lobe is well-marked, and it is also clearly seen in some Swedish Silurian forms, such as *B. polyactin*, Ang. (22, p. 87, pl. xiv. fig. 4), and *B. crebristriatus*, Lindstr. (22, p. 89, pl. xvi. fig. 22). A similar but more developed paraglabellar structure is found in certain species of *Homalonotus* (14 b, p. 164).

In the *signatus* group the three pairs of lateral furrows are clearly developed in some cases (*B. polyactin*, Ang., and *B. planus*, Corda), but in others, such as *B. andersoni*, Nich. & Eth., and *B. platyactin*, Ang., they are reduced in strength and size and represented by isolated small grooves or pits, all more or less indistinct and difficult to identify.

In *B. polyactin*, Ang. (22, t. xiv. fig. 4), the furrows on the glabella, being distinct, enable us to interpret the more modified and obscure lateral furrows on the glabella of many of the other Silurian and Devonian species. The first pair of lateral furrows are nearly horizontal and extend about one-third across the glabella on each side, entering the axial furrows without much loss of strength; the second pair are curved and most strongly marked at their inner ends, becoming faint towards the sides; the third pair is curved concave-forwards and by nearly joining the inner ends of the second pair circumscribe more or less clearly a subcircular second pair of lateral lobes; the basal (third) lateral lobes are undefined internally and form the expanded base of the neck of the glabella. The meso-occipital furrow is simple. There are no occipital lobes.

In the Baltic species *B. estonicus*, Schmidt (16, p. 36, t. iii. figs. 1-7), the glabella is more like that of the Scotch *B. andersoni*, the lateral furrows being obsolescent, but it is regarded by Schmidt to be similar to the Swedish *B. polyactin*, Ang., which Lindström (*op. cit.*) has fully described.

A considerable number of the Bohemian species described by Barrande from the Silurian Stage E have the head-shields well preserved, and the whole trilobite is occasionally preserved. In some (e. g., *B. haidingeri*, Barr. (7, p. 875, pl. xlv. figs. 32-39)), there are three pairs of glabellar furrows easily distinguishable, though often consisting only of isolated pits, and there is frequently an inner pair of similar pits between the inner ends of the first and second lateral furrows, perhaps indicating their former connection. The second lateral lobes may be circumscribed by the union of the second and third lateral furrows, which are rather closely placed (e. g., *B. haidingeri*), but the first lateral lobes are not enclosed. Occipital lobes are occasionally developed, and in some species they are

connected by a supplementary transverse furrow which divides the meso-occipital ring in half (*B. partschi*, Barr. (7, p. 870, pl. xlv. fig. 23)).

But there is a less modified group of species represented by *B. planus*, Corda (7, p. 863, pl. xlii. figs. 34, 35, pl. xlviii. figs. 1-8), in which three lateral furrows of the glabella are represented by simple more or less horizontal grooves, and the meso-occipital ring is simple and devoid of occipital lobes or transverse furrow. This species in other respects shows primitive characters, such as the pre-glabellar area being well developed, as Henriksen (13, p. 18) has pointed out.

Amongst the Silurian species in Australia *B. jenkinsi*, Eth. & Mitch., has three pairs of lateral furrows on the glabella, but the first and second pairs are isolated pits and the third pair mere notches at the sides of the glabella.

The American species from Silurian beds comprise the following: *B. [Goldius] acamas*, Hall, *B. aquilonaris*, Whiteaves, *B. laphami*, Whiff., and *B. occasus*, Winch. & Marcy, from the Niagara, and *B. niagarensis*, Hall, from the Clinton, but in none is the head-shield known, so far as the present author has been able to ascertain.

In the case of the Hercynian (Lower Devonian) species from Stages F and G in the Bohemian area we notice generally the demarcation and circumscription of the large first lateral lobes by the development of an inner longitudinal furrow, which connects the first and second and often the third lateral furrows on each side; the second lateral lobes are much reduced in size and usually are circumscribed by the union of the second and third furrows; the meso-occipital furrow has become much broader, pushing the base of the glabella forward. A typical example of this group is found in *B. umbellifer*, Beyr. (7, p. 879, pl. xlv. figs. 13-24, pl. xlviii. figs. 28-30; 7 a, p. 137, pl. xvi. figs. 23, 24), a species which has numerous allies, *B. formosus*, Barr., *B. viator*, Barr., *B. porosus*, Barr., *B. billingsi*, Barr., *B. angusticeps*, Barr. (6, p. 22, t. i. figs. 28, 30, 32), etc. The first lateral lobe is large and well circumscribed, and it has a subquadrate or subtriangular shape; the first lateral furrow is strong and more or less horizontal and is connected by a longitudinal or bent furrow with the second furrow; the second and third furrows are short, much reduced, and close together; the second lateral lobe is very small and nodular; the third lateral lobes are not enclosed. Ocular ridges are generally present in this type. In *B. palifer*, Beyr. (7, p. 859, pl. viii. fig. 31, pl. xlv. figs. 1-21; 7 a, p. 129, pl. xvi. figs. 21, 22), the forward position of the base of the glabella and the wide smooth space between it and the narrow meso-occipital ring are special features; the inflation of the neck of the glabella, which is carried to a still greater extent in *B. rhinoceros*, Barr. (7 a, p. 131, pl. ix. figs. 12-19), in which it becomes a horn, is noticeable; the subtriangular occipital lobes are more developed than in the Silurian *B. partschi* and *B. haidingeri*, and become so large that they

nearly touch the third lateral furrows. The large first lateral lobe is a feature as in the *B. umbellifer* group, but in *B. palifer* and its allies the first lateral lobe is usually less clearly circumscribed, the internal longitudinal furrow being indistinct or incomplete, and the second lateral lobe is also less definite, being also small and generally less clearly enclosed by the union of the furrows. There is also an inner pair of pits about halfway between the first and second lateral furrows which may represent the isolated ends of the backward-curved first furrows or the remains of a longitudinal furrow. The third lateral lobes in neither group are marked off clearly from the rest of the glabella, and seem to form part of its swollen neck.

In *B. rhinoceros*, Barr. (7 a, p. 131, pl. ix. figs. 12-19), and its ally, *B. furcifer*, Corda (7, p. 858, pl. xlviii. figs. 36-38; 7 a, p. 126, pl. xi. figs. 12-18), the large first lateral lobes of the glabella are somewhat similarly developed, but the peculiar palpebral spines on the head-shield and on the swollen neck of the glabella are special peculiarities; there is a longitudinal furrow connecting the inner ends of the first, second, and third lateral furrows much as in *B. umbellifer*, and the second lateral lobes are much reduced and subnodular. The imperfectly known Canadian species *B. manitobensis*, Whiteaves (24 a, pl. xlv. figs. 5-7), from the Devonian of Manitoba, has the peculiar palpebral spines of *B. rhinoceros*.

There is another group of Hercynian species typified by *B. campanifer*, Beyr. (7, p. 844, pl. xlv. figs. 1-12), and including *B. dormitzeri*, Barr. (7, p. 847, pl. xlviii. figs. 39-48; 8, p. 39, t. v. figs. 1-3), and *B. brongniarti*, Barr. (7, p. 866, pl. xlv. figs. 1-12), in which the glabellar lobes and furrows are nearly obsolete. This feature seems correlated with the swollen condition of the glabella and affects also the furrows on the pygidium as above described. The excessive glabellar inflation is accompanied by the reduction of the preglabellar area and the enlargement of the rostral shield on the inferior surface of the cephalon. The Devonian of France has yielded two species, *B. verneuli*, Oehl. & Dav. (35, p. 703, pl. xii. figs. 2, 2 a-c), and *B. galloisi*, Oehl. (36, p. 764, pl. xviii. figs. 2, 2 a), which belong to this group and show the convexity of the glabella and obsolescence of the lateral furrows.

Barrande did not attempt to classify the Bohemian species of *Bronteus* by means of the structure of the head-shield, but we have seen that there are some striking differences in the characters of the glabella and that on the strength of them we can recognise at least four distinct Hercynian groups, typified by *B. umbellifer*, *B. palifer*, *B. rhinoceros*, and *B. campanifer*.

The Middle and Upper Devonian species possess another rather distinctive development of the glabella and its furrows and lobes. The progressive reduction in size and squeezing out of the second lateral lobes by the approximation and shortening of the second and third lateral furrows is a feature. The first lateral furrows are well marked, usually rather long, straight, and horizontal; the first

lateral lobe is large, though not well defined behind or circumscribed (except in the *B. speciosus* group). The second and third lateral furrows may unite internally and thus circumscribe a small nodular second lobe on each side. Behind them there is usually a transverse furrow extending right across the neck of the glabella and more or less clearly separating off a broad ring in front of the true meso-occipital ring, as may be observed in *B. costatus*. The homology of this furrow, which appears to be a new or supplementary structure, is doubtful. There is also a small isolated pair of sub-central pits between the ends of the first and second lateral furrows which may represent remnants of the inner longitudinal furrows.

Fig. 2 g.

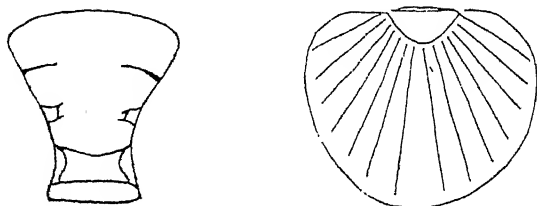
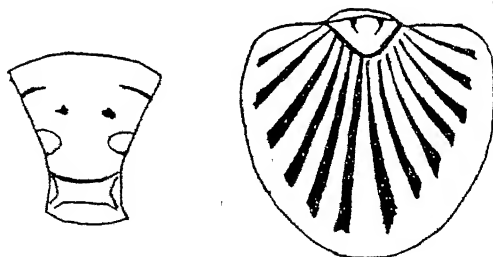
*Bronteus flabellifer.*

Fig. 2 h.

*Bronteus costatus.*

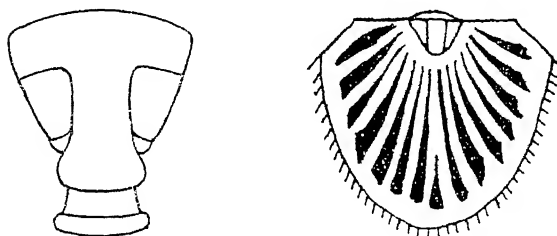
These pits which are probably similar to those in *B. palifer* as above noticed are well seen in *B. delicatus*, Whidb. (29, p. 33, pl. iii. figs. 13, 14), and in the head-shield figured by Whidborne (29, p. 40, pl. iii. figs. 8-10) as *B. granulatus*, Goldf.

In the figure of a nearly perfect specimen of *B. flabellifer* given by Goldfuss (19, t. vi. fig. 3; 19 a, p. 35, t. xxxiii. fig. 3 a) the glabellar furrows and lobes are almost identical with Whidborne's *B. pardalios*, but Whidborne does not allude to this. Holzapfel (32, p. 13, t. xiii. figs. 5-10, t. xvi. fig. 18) considers Whidborne's *B. tigrinus* to be identical with *B. granulatus*, Goldf., and he figures this species with two pairs of lateral furrows on the glabella and one complete transverse one behind as above noticed. *B. novaki*,

Holz. (32, p. 10, t. ii. figs. 11-14), has apparently one or two pairs of very short lateral furrows of which the correlation is uncertain. A Middle Devonian species from Kusnetz, West Siberia, named *B. elegans* by Von Peetz (37, pp. 28, 369, t. i. figs. 4*a*, *b*), has the characteristic glabellar lobation of *B. pardalios*, and *B. sibiricus*, Tschern. (38, p. 10, t. ii. figs. 1*a*, *b*), from the Devonian of the Altai, is marked by the large quadrate first lateral lobes of the glabella (as in *B. speciosus*) and the apparent suppression of the second pair, thus denoting an extreme case of their reduction in this group.

On the other hand, in the Upper Devonian species, *B. senescens*, Clarke (11*a*, p. 734, figs. 3, 4), from New York, the three lateral furrows are said to be distinct, though the middle ones are mere depressions, and there are no circumscribed first lateral lobes—but this is an unusual character.

In the *Thysanopeltis* group (type, *B. speciosus*, Corda), which is often separated as a distinct genus, the longitudinal interior furrow joining up the first and second lateral furrows is well

Fig. 2*i*.*Bronteus speciosus*.

developed, the second lateral lobe is much reduced, and the neck of the glabella is much elongated. This genus or subgenus *Thysanopeltis* was founded by Corda (30, p. 117, pl. vi. fig. 64) for a species *T. speciosa* from Stage E in Bohemia, which he believed was distinguishable from *Bronteus* (1) by an ovoid protuberance placed between the eye and the posterior margin of the cheek, and (2) by a marginal fringe of spines on the pygidium. But Barrande (*op. cit.* p. 838) denies the existence of the protuberances and does not consider the marginal spines to be of generic importance. The genotype, which was named by Corda *T. speciosa*, was subsequently termed by Barrande (7, p. 843, pl. xlvii. figs. 6-17; 7*a*, p. 135, pl. xvi. figs. 25, 26) *B. thysanopeltis* in his redefinition of the species, and Novak (8, p. 36, t. iii. figs. 10-16) later on gave a fuller description of it, mentioning the variation in the shape and proportions of the pygidium and in the point of bifurcation of the postaxial middle "rib." Woodward (39, pp. 407-410) was inclined to separate *B. speciosus* from *B. thysanopeltis*, but this is

not an opinion usually held, nor does it seem justified. In *B. thysanopeltis*, as generally understood, the glabella has one pair of large subquadrate first lateral lobes completely enclosed by the internal union of the first and second lateral furrows by a longitudinal furrow; the second lateral lobes are reduced to mere tubercles, the second and third lateral furrows uniting round them and scarcely separable. The seven pairs of ribs on the pygidium are narrow raised ridges separated by broad sunken interspaces and united distally by the raised border, which bears along its margin many spines. The postaxial median rib is bifurcated and the axis is trilobed. There is no correspondence between the marginal spines and the ribs. The thoracic pleuræ are furrowed on their inner portion and produced distally into free spinose ends.

B. clementinus, Barr. (7 a, p. 124, pl. i. figs. 9, 10), is another Bohemian species from Stage G belonging to this subgenus, but the marginal spines agree with the ribs in number and position.

Richter (10 b, p. 91) has figured and described another species, *B. (T. acanthopeltis*, Schnur, from the Middle Devonian of the Eifel, and Woodward (39, p. 408, text-fig. 1) another one from Gerolstein, *B. halli*, both of which have a reduced number of marginal spines round the pygidium, and in the latter species the axis is not trilobed.

There are several allied species from the Devonian of France, *B. barrandii*, Hébert, *B. raphaeli*, Barrois (40, p. 131, pl. iii. fig. 2), *B. trutati*, Barrois (40, p. 134, pl. iii. fig. 3), *B. meridionalis*, Trom. & Gras. (42, p. 474), and *B. rouvillei*, Frech (42, p. 475).

Barrois (*op. cit.*) remarked that *Thysanopeltis* formed a section of *Bronteus* parallel to that of *Oriphaeus* (= *Asteropyge*) amongst the Dalmanitidæ, and Hall recognised that it constituted a distinct group of species. We may add that there is a somewhat parallel development in *Eisfiarges* (4 b, p. 55) amongst the Lichadidæ. The best-known American species is the Upper Devonian *B. tullius*, Hall (12, p. 12, pl. viii. a, figs. 34-36), based on the pygidium, but the Richters (4 a, p. 124) see no reason for putting it in this group, and consider it more allied to *B. costatus* (Pusch).

The relations of the head-shield of *Thysanopeltis* seem to be with the groups of *B. umbellifer* and *B. rhinoceros*, the lateral lobes of the glabella being somewhat similar and the protuberance between the eye and posterior margin being apparently of the same nature as the palpebral spine in *B. rhinoceros*.

With regard to the classification of the species, we can now recognise the following main groups in which they may be arranged on the strength of the pygidial, thoracic, and glabellar characters:—

GROUP 1.

Pygidium with six pairs of lateral ribs (= three pairs of pleuræ) and a single undivided or faintly grooved median postaxial piece; ribs broad; intercostal furrows fine, linear. Thorax with pleuræ

forming simple flattened bands of uniform width in contact for their whole length except at their extreme tips.

Glabella with three pairs of furrows represented by isolated pits, varying somewhat in development. This group is entirely limited to the Ordovician.

Type, *B. laticauda*, Wahl. (*Eobronteus*, subgen. nov.). (Fig. 1.)

GROUP 2.

Pygidium with seven pairs of lateral ribs (=three and a half pairs of pleuræ) and a postaxial piece which may be simple or grooved along its middle or bifurcated at its distal end.

Thoracic pleuræ furnished with marginal bands for part of their length; the outer part of each pleura may be free beyond a constriction. Glabella with lateral furrows variously developed. (Subgen. *Bronteus*, sens. str.)

Subgroup (a).—Pygidium with ribs broad; intercostal furrows fine, linear; postaxial piece simple or faintly grooved for part or whole of its length. Thoracic pleuræ in contact for most of their length, forming flattened or gently convex bands, without distinct constriction.

Glabella with three pairs of more or less well-marked furrows.

Type, *B. planus*, Corda. Stage E. (Fig. 2a.)

Subgroup (b).—Pygidium with ribs somewhat narrowed, furrows wide; postaxial piece slightly bifurcated distally.

Thoracic pleuræ with faint constriction at about two-thirds their length; outer third forming long free point.

Glabella with three pairs of lateral furrows represented by isolated pits.

Type, *B. haidingeri*, Barr. Stage E. (Fig. 2b.)

Subgroup (c).—Body strongly convex. Pygidium with broad nearly obsolete ribs and faint linear intercostal furrows; axis broad, simple; postaxial piece bifurcated distally.

Thoracic pleuræ with well-marked constriction at less than half their length and long outer free spinose portion.

Glabella with furrows and lobation nearly or quite obsolete.

Type, *B. campanifer*, Beyr. Stage F. (Fig. 2c.)

(= *Paralejurus*, Corda.)

Subgroup (d).—Pygidium with narrow raised ribs separated by wide grooves; strongly bifurcated postaxial piece.

Thoracic pleuræ slightly constricted at half their length; outer half forming free spines.

Glabella with three pairs of furrows at unequal distances apart; first lateral lobe large, more or less circumscribed; second lateral lobe small, nearly enclosed by union of second and third furrows.

Type, *B. palifer*, Beyr. Stage F. (Fig. 2d.)

Subgroup (e).—Pygidium with ribs rather narrow, separated by strong furrows; postaxial piece slightly bifurcated at distal end.

Thoracic pleuræ constricted at about half their length; outer portion spinose, free.

Glabella with pair of inner longitudinal furrows more or less developed; first lateral lobe subquadrate, very large, circumscribed; second lateral lobe subnodular, very small; first lateral furrow long; second and third lateral furrows very short and united round second lobe.

Type, *B. umbellifer*, Beyr. Stage F. (Fig. 2 e.)

Subgroup (f).—Pygidium with narrow ribs separated by furrows as wide as or wider than ribs; postaxial piece deeply bifurcated, resulting in the production of a nearly separated eighth pair of ribs, all ending abruptly at indefinite border. Axis trilobed.

Thoracic pleuræ unknown.

Head-shield with neck-ring and palpebral lobes furnished with long spines.

Glabella with first and second lateral lobes more or less fused together and circumscribed. Lateral furrows pit-like or weak.

Type, *B. rhinoceros*, Barr. Stage F. (Fig. 2 f.)

Subgroup (g).—Pygidium with broad ribs well defined, separated by narrow linear furrows; postaxial piece simple, undivided; axis simple. Thorax with pleuræ weakly constricted; outer portion free, more or less spinose.

Glabella with first lateral furrows well marked, horizontal; first lateral lobe large. Second and third lateral furrows much reduced and united to circumscribe very small tubercular second lobe, which may be squeezed out completely.

Type, *B. flabellifer*, Goldfuss. Middle Devonian. (Fig. 2 g.)

Subgroup (h).—Pygidium with moderately broad ribs separated by rather wide intercostal furrows ending abruptly within the margin; postaxial piece simple, undivided. Axis weakly trilobed. Thorax with pleuræ weakly constricted; outer portion free, spinose. Glabella with first lateral furrows strong, horizontal; second and third lateral furrows very short and united to circumscribe small tubercular second lobe; first lateral lobe not circumscribed; pair of submedian pits present between first and second lateral furrows.

Type, *B. costatus*, Pusch. Middle and Upper Devonian. (Fig. 2 h.)

Subgroup (i).—Pygidium with narrow raised ribs separated by furrows as wide as, or wider than them; postaxial piece deeply bifurcated; pygidial margin with definite raised border armed with spines. Thorax with outer half of pleuræ as free spines. Glabella with first lateral lobes large, well circumscribed, subrhomboidal; second lateral lobes small, nodular; first, second, and third lateral furrows united internally.

Type, *B. speciosa*, Corda (=subgen. *Thysanopeltis* auctt.). Stages F and G. Lower and Middle Devonian. (Fig. 2 i.)

The last subgroup (*i*), consisting of those species with marginal spines round the pygidium, is marked not only by this unique feature, but also by the large circumscribed first lateral lobes of the glabella. It seems capable of division into two subsections, in one of which the marginal spines correspond in number and position with the ribs, but in the other they are more numerous and not related to them. The pygidium has a definite raised border against which the ribs end; the axis is always trilobed and the ribs are very narrow and raised; the median one is strongly bifurcated, and the intercostal furrows are wide and strong. This group constitutes the subgenus *Thysanopeltis*, the two subgroups being represented respectively by *B. acanthopeltis* and by *B. speciosus*.

It must be noticed that the *palifer* and *thysanopeltis* groups agree in having the pygidium modified in the same manner by the development of the ribs and intercostal grooves into radial struts. We can either regard this common feature as a case of convergence in groups not phylogenetically connected and as merely identical adaptations to similar conditions, or as indicating that the *thysanopeltis* group, which is the later stratigraphically to appear, is a direct descendant of the *palifer* group and has inherited its peculiar pygidial characters. The close resemblance in the lobation of the glabella in both groups inclines us to prefer the latter view.

In the case of the *haidingeri* and *costatus* groups we find an intermediate state in the strut-like development of the ribs, while the intercostal grooves are less wide than in the *palifer* group but wider than in the *planus* group. The glabellar characters in both have a great resemblance, and we are therefore likewise inclined to regard these groups as genetically connected.

CONCLUSION.

The following classification of the members of the genus *Bronteus* may therefore be suggested:—

Genus *Bronteus* (= *Goldius* = *Scutellum*).

Group 1.—Subgenus nov. *Eobronteus*. Type, *B. laticauda*, Wahl.

Group 2.—Subgenus *Bronteus*, sens. str.

Subgroup <i>a</i> .	Type, <i>B. planus</i> , Corda.
„ <i>b</i> .	„ <i>B. haidingeri</i> , Barr.
„ <i>c</i> .	„ <i>B. campanifer</i> , Beyr.
„ <i>d</i> .	„ <i>B. palifer</i> , Beyr.
„ <i>e</i> .	„ <i>B. umbellifer</i> , Beyr.
„ <i>f</i> .	„ <i>B. rhinoceros</i> , Barr.
„ <i>g</i> .	„ <i>B. flabellifer</i> , Goldf.
„ <i>h</i> .	„ <i>B. costatus</i> , Pusch.
„ <i>i</i> .	„ <i>B. speciosus</i> , Corda.

The rank of the two subgroups of *B. speciosus* and *B. campanifer*, to which some authors have attached respectively the subgeneric names *Thysanopeltis* and *Paralejurus*, is a matter of

opinion; but it may be pointed out that the differences between each of them and the type of the whole genus *Bronteus* are hardly greater than those between the other subgroups here specified. However, in the case of the Phacopidæ subgeneric, or even generic, divisions have been established on no stronger distinctive characters, and the divisions or groups have received special names. The present author is, nevertheless, loath to introduce a number of new terms to designate subgroups of species which have so many features in common.

If we look at the whole range of variations in the structure of the Bronteidæ, from the earliest Ordovician species to the latest Devonian representatives, it will be observed that there is a generally continuous but rather irregular series of modifications of the pygidium and to a less extent of the glabella and head-shield, but that divergences in structure have occurred in several directions often simultaneously in species of the same period without any definite trend to one goal. No regular consecutive series of phylogenetic changes seems to be traceable in the life of the family except in the pygidium, even when we are able to deal with such a varied and complete succession of species in one area as Barrande described. Similar adaptations of structure to suit similar conditions seem also to have been repeated by different groups at different stages in the history of the genus.

The Genus BRONTEOPSIS.

Owing to the general custom of including the genus *Bronteopsis* in the family Bronteidæ, the following remarks on the author's reasons for removing it to the Styginidæ seem to be requisite.

The type of the genus *Bronteopsis*, Nicholson & Etheridge, of the Lower Ordovician, which has been recently discussed by Raymond (1*e*, pp. 68-71), is *B. scotica*, Salter (14, p. 94, pl. xiii. figs. 5-13; 14*c*, p. 26, pl. iv. fig. 6), but no independent diagnosis of the generic characters has been given. Salter, Etheridge, and the present author till now have placed this genus in the Bronteidæ (=Goldiidæ). A new Scotch species *B. ardmillanensis*, Reed (14, p. 92, pl. xiii. figs. 1-4; 14*c*, p. 26, pl. iv. fig. 7), was described in 1904. Raymond (1*e*, pp. 69, 70, pl. iii. figs. 12-14) has described two new species from America and Newfoundland, one of which (*B. gregaria*, Raymond) only slightly differs from *B. ardmillanensis*. The latter also has an allied form occurring in the Chasmops Limestone of Sweden, *B. nitens*, Wiman (41, p. 113, pl. viii. figs. 19, 20), which was attributed by its author to the genus *Holometopus*, Angelin (21, p. 58), but Raymond is of the opinion that *Holometopus* is closely allied to, or perhaps inseparable from, *Bronteopsis*, and with this view the present author agrees. The type-species, *B. scotica*, which is recorded also by Raymond (1*e*, p. 69) from Newfoundland, is related to *Ogygia* in the characters of the head-shield and to *Barrandia* in those of

the pygidium as well as to *Bronteus*, as was noticed by Salter and Nicholson and Etheridge, while its affinities to *Ogygia* (?) *concentrica*, Linnarss., were observed by the present author (14, p. 94), but we may here draw attention to the resemblance of the head-shield and glabella of both *B. scotica* and *B. ardmillanensis* to *Bronteus laticauda*. Raymond, while now inclined to place *Bronteopsis* in the Styginidæ (1 f, p. 283), owing to the resemblance of its pygidium to that of *Stygina*, believes that the Styginidæ (if established as an independent family) are more allied to the Goldiidæ than to the Asaphidæ, and it seems that they exhibit a combination of the characters of these two families.

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ADDENDUM.—Since the above went to press, my attention has been drawn to a recent paper by Th. Heller, entitled "Die Fauna der obersilurischen Orthocerenkalks von Elbersreuth" (Geognostische Jahreshefte, xxxviii., München, 1926, pp. 200–203, t. i. figs. 2a, 2b, 3, 4), in which six species of *Bronteus*, bearing Münster's specific names, are recorded or described, and three of them (*B. nilsoni*, *B. neptuni*, and *B. radiatus*) are figured. *B. nilsoni* and *B. neptuni* clearly belong to my group 2, subgroup A, but with regard to *B. radiatus* Heller states that some of the specimens of this species possess eight pairs of ribs on the pygidium and some others only seven. His figure (*op. cit.* t. i. fig. 3) shows eight pairs and a much broader simple postaxial piece, and there is an unusually broad smooth border. The characters of this pygidium are undoubtedly peculiar, but the head-shield is apparently still unknown, and the position of the species must remain uncertain.—F. R. C. R., Nov. 28th, 1927.

IV.—On the Algal Nature of *Aroides stutterdi*, Carruthers.

By W. N. EDWARDS.

[Plate III.]

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IN 1867 (p. 164), Carruthers described some specimens from the Stonesfield Slate which he regarded as part of the spadix of an Araceous plant, and consequently named *Aroides stutterdi*. Prof. Seward later pointed out that it was most unlikely that this problematical fossil was really a monocotyledonous plant, and in 1904 (p. 155) he gave all the earlier references to it in geological literature and summarized previously expressed opinions. He referred to Dr. H. Woodward's suggestion that the fossil was the anal sac of a crinoid (a view rejected by Dr. F. A. Bather), and left its true position quite undecided. So far as I know, no further suggestion as to its nature has been made since.

With our increased knowledge of fossil calcareous algæ, it now seems possible to place *Aroides stutterdi* with a far greater degree of probability. The cylindrical fossil, externally covered with roughly hexagonal calcareous plates, fitting closely together and apparently arranged in vertical rows, at once suggests one of the Siphonææ Verticillatæ. The type-specimen (now in the Oxford Museum) fortunately shows something of the internal structure, and the photographs now given (Pl. III. figs. 1 & 2) show even more clearly than Carruthers's drawings (1867, pl. viii. figs. 2*b*, 2*c*) that the plates are the closed terminations of hexagonal tubes. The external appearance of vertical rows of hexagonal areas is due to the arrangement of the tubes in alternating whorls. These features again point to the Siphonææ Verticillatæ.

I have seen no trace of internal structure in any other specimens, and probably calcification was largely external. Both Carruthers and Seward lay stress on the irregularly dentate margins of the plates, which dovetail into one another. This seems to be a distinctive feature, though the sinuations were probably not really very irregular, and the general hexagonal outline is usually quite clear except in crushed or poorly preserved specimens. Sometimes, as in Pl. III. fig. 3, the areas are regularly hexagonal, and this may be due to the fact that the specimen is a cast only, the actual calcified plates having disappeared. The plates themselves are not well preserved in the type-specimen, nor indeed in any of the material at my disposal. Figs. 4 and 5 on

Pl. III. show the plates in two fragments from Stonesfield, and of these fig. 4 is the better preserved.

Aroides stutterdi is much like a calcareous alga described by Lignier (1911) from the Middle Bathonian of Mamers (Sarthe). Lignier at first referred his specimen to a Triassic species, *Gyroporella vesiculifera*, Benecke, but realizing later (Lignier, 1913) that the two were distinct, he named the Mamers fossil *Goniolina cylindrica*. The genus *Goniolina*, which has long been known from Upper Jurassic rocks, was regarded by Saporta as the fruit of a primitive angiosperm, though its algal nature was pointed out by Steinmann in 1880. In 1922 Pia discussed Lignier's fossil, and, finding certain important differences from *Goniolina*, he instituted for it the new genus *Stichoporella*. In the latter the verticillate branches were simple (in *Goniolina* they bore, according to Pia, three assimilatory cells), and as the number of branches in each alternating whorl was the same, the calcified outer membranes were arranged in regular longitudinal rows, which are not so apparent in *Goniolina*. *Stichoporella* was cylindrical, and *Goniolina* ovoid or spherical, with a naked axis below. *Stichoporella* occurs in Bathonian rocks, while *Goniolina* ranges from Upper Oxfordian to Upper Kimmeridgian, being commonest, according to Pia, in the Lower and Middle Kimmeridgian.

An examination of Lignier's figure of *Stichoporella cylindrica* (1911, pl. i. fig. 8) reveals its close resemblance to *Aroides stutterdi*, and the internal structure of the former (Lignier, 1913, p. 71, fig. 1), though apparently somewhat better preserved, is obviously comparable with that shown on Pl. III. fig. 1.

The two are evidently generically identical, but there is sufficient difference to separate them specifically. The Stonesfield fossil should therefore be re-named

Stichoporella stutterdi (Carruthers), comb. nov.,
and take its place among the Jurassic Dasycladaceæ. It differs from *S. cylindrica* in the dentate and dovetailing margins of the calcified membranes, and also perhaps in the slightly greater size of the hexagonal areas (which are from 1.5 to 2.5 mm. in diameter; in *S. cylindrica* they are 1.25 mm.). According to Lignier, *S. cylindrica* was rather worn, but in places there was a thin calcified pellicle over the areas, and a narrow calcareous ridge between them (see his fig. 9 b, pl. i.). Both species appear to have had about the same number of tabular whorled branches (estimated at 16 to 18), and the two were about the same size; *S. cylindrica* had a diameter of 15 mm. and *S. stutterdi*

(type-specimen) of 17 to 18 mm. The length in each case is unknown; I have not seen any piece of *S. stuttermi* longer than 3 cm. The variety in appearance of the British specimens seems to be due mainly to differences in preservation, and there is no evidence for the presence of more than one species.

As already stated, *S. cylindrica* was found in Middle Bathonian rocks in France; in England *S. stuttermi* occurs at about the same horizon, in the Stonesfield Slate, and also a little lower, in the Lincolnshire Limestone of Northamptonshire (Upper Bajocian). It has recently been recorded from the Bathonian (zone of *Rhynchonella concinna*) of Rinxent, France, by Dutertre (1926), who refers to it as a problematical organism, but does not give a figure.

In conclusion, it may be remarked that Carruthers's species had nothing whatever to do with Kutorga's *Aroides crassispatha*. Carruthers followed Kutorga in using *Aroides* as a form-genus, and *A. crassispatha* is probably the leaf-bud of some gymnospermous plant.

I am indebted to Mr. J. A. Douglas for information about the type-specimen, to Mr. C. J. Bayzand, of the University Museum, Oxford, for facilitating my examination of Carruthers's material, and to Dr. F. L. Kitchin for the loan of a specimen from the Survey Museum, Jermyn Street.

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EXPLANATION OF PLATE III.

All the figures are of *Stichoporella stuttermi* (Carr.), Edw., and are magnified two diameters. The photographs are by H. G. Herring.

- Fig. 1.* Transverse section of the type-specimen. Oxford Museum.
Fig. 2. Half of the type-specimen with a small part cut longitudinally, showing the hexagonal tubes. Oxford Museum.
Fig. 3. A fragment showing hexagonal areas. *Brit. Mus. N. H., Geol. Dept.*, no. V. 3442.
Fig. 4. Fragments of a crushed specimen with calcareous plates. *Brit. Mus. N. H., Geol. Dept.*, no. V. 5585.
Fig. 5. A crushed specimen showing interdigitating calcareous plates. *Mus. Geol. Surv.*, no. 2260.

V.—*New or little-known Tipulidæ (Diptera).—XXXVII. Australasian Species.* By CHARLES P. ALEXANDER, Ph.D., F.E.S., Massachusetts Agricultural College, Amherst, Massachusetts, U.S.A.

In the present paper, a portion of the Australian and Tasmanian species of crane-flies belonging to the tribe Hexatomini that were taken by Dr. André L. Tonnoir are discussed. A few additional specimens secured by Mr. Hardy (in the University of Queensland Collection) and Mr. Hill (in the National Museum, Victoria) are included. The rich Tonnoir collections have been returned to Dr. Tonnoir, and will presumably be placed in one of the leading Australian Museums. I wish to express my sincere thanks to Messrs. Hardy, Hill, and Tonnoir for the privilege of studying this abundant material.

The localities in New South Wales, Victoria, and Tasmania where Dr. Tonnoir collected have been discussed in a previous instalment (Ann. & Mag. Nat. Hist. ser. 9, vol. xix. pp. 18–19, 1927), which should be consulted for further information.

In the present paper and others under this general title, the writer has adopted the modifications of venation affecting the radial field, as discussed in detail in other papers now in press ("The Interpretation of the Radial Field of the Wing in the Nematocerous Diptera," Proc. Linn. Soc. New South Wales, 1927; "The Oriental Tipulidæ in the Collection of the Indian Museum," Part I., Rec. Indian Museum, 1927). These papers should be consulted by students interested in the problem.

TONNOIRELLA, gen. nov.

Rostrum long and slender, about twice as long as the head and only a little shorter than the antenna. Antennæ of moderate length, the flagellar segments cylindrical, with relatively short and inconspicuous verticils. Vertex at narrowest point conspicuously hollowed out. Cervical sclerites conspicuous. Pronotum massive. Pseudosutural foveæ small, placed far laterad; no tuberculate pits. Legs relatively long and slender; tibial spurs distinct. Wings with Sc long, Sc_2 at its tip; R_s elongate, angulated at origin; R_{2+3+4} shorter than $m-cu$; cell R_3 very deep, veins R_3 and R_4 lying generally parallel; basal section of R_2 near the tip of R_{1+2} ; R_{2+3} about one-half longer than R_3 alone; cell M_1 very deep, its petiole very reduced, subequal to or

shorter than m ; cell 1st M_2 large, its inner end lying proximad of the remaining elements of the cord; $m-cu$ transverse, in alignment with $r-m$, at a little less than its own length beyond the fork of M ; anterior arculus lacking. Macrotrichiæ relatively sparse and inconspicuous, there being none on R_s , R_{2+3+4} , or the veins proximad of the cord, excepting R and the outer ends of the Anal veins. Male hypopygium massive, the segments fused into a ring. Ninth tergite with the median region produced into a flattened depressed ledge that is deeply notched medially, the lobes thus formed being obtusely rounded at their tips. Sternal region membranous, the median area only slightly produced into a low lobe. Basistyle short, stout, tumid, the outer face with setæ that are longer and stouter on distal third; ventro-mesal face of style with a cushion that is densely set with short golden setæ; no apical lobes. Dististyles two, united at base, the outer style stouter, more flattened outwardly. Gonapophyses appearing as powerful chitinated rods, near the tips a little expanded, terminating in a short, gently-curved hook. Anal tube conspicuous. Ovipositor with the valves elongate, heavily chitinated, the tergal valves more slender, gently upcurved.

Genotype, *Tonnoirella gemella*, sp. n. (Australian Sub-region).

The present group is named in honour of my friend, Dr. André L. Tonnoir, to whom our greatest advance in knowledge of the Nematocera of Tasmania and South-Eastern Australia is due. *Tonnoirella* should be placed with *Tinemyia*, Hutton, and *Rhamphophila*, Edwards, among the lower Epiphragmaria. The condition of the rostrum is somewhat intermediate between the two genera named. The hypopygium is relatively simple in structure, without the conspicuous outgrowths of the basistyle and ninth sternite of *Rhamphophila*. The venation is characterized by the unusual depth of the cells beyond the cord, the petioles of cells R_3 and M_1 being unusually short. The trichiation of the veins is sparse and inconspicuous.

Dr. Tonnoir has supplied the following field-notes:—

"This I collected on Mt. Field on the slope of the range that goes down towards the nearly unexplored part of the country extending towards the south-west. I had just arrived on the summit at noon, and the guide took me down in a deep valley where I expected to find some Blepharocerids. It was on the down track that this species was so abundant on the flowers of *Dracophyllum*. I collected the lot that was submitted to you, noted that there were three specimens

with marmored wings and looked for more, but we had to go on. I had in mind to come back the following day, but it turned so wet during the rest of my stay in the range that I could scarcely go out of the hut."

Tonnoirella gemella, sp. n.

Wings strongly tinged with yellow, the darker pattern very sparse.

Male.—Length (excluding rostrum) 13 mm.; wing 16 mm.; rostrum alone 2.5 mm.

Rostrum and palpi black, the former with short erect black setæ. Antennæ arising from before the eyes, black throughout. Head dark grey, the dished-out region of the vertex more yellowish.

Cervical sclerites dark grey. Pronotum dark brown, the anterior notum more pruinose. Mesonotal præscutum grey, with four dark brown stripes, the lateral margins of the sclerite similarly dark brown; scutum grey, the median area immediately behind the suture more brownish, the lobes nearly black; scutellum dark grey, with an impressed dark spot at base on either side of median line, the parascutella black; postnotum black, the sides dusted with grey. Pleura dark grey, the pleurotergite clearer grey. Halteres yellow, the base brighter yellow, the knobs dark brown. Legs with the coxæ dark brown, sparsely pruinose; trochanters obscure yellow, the tips darkened; remainder of legs brownish black, the femoral bases very narrowly obscure yellow, more extensively so on the fore femora. Wings with a strong yellow tinge, the base and costal region brighter yellow; stigma strongly yellow, the ends brown, the outer end more extensively so; an extensive brown blotch at the fork of *M*, this preceded and followed by a clear spot; anal angle narrowly margined with brown; veins brown. Venation as described under the generic diagnosis.

Abdomen brownish yellow, the lateral margins of the outer sternites brown; segments seven and eight brownish black; hypopygium obscure fulvous. Male hypopygium as described under the generic diagnosis.

Hab. Tasmania.

Holotype, ♂, Mt. Field, altitude 3500 feet, December 18, 1922 (*A. Tonnoir*).

Paratopotypes, 8 ♂♂, December 18, 1922.

Tonnoirella gemella marmoripennis, subsp. n.

Female.—Length (excluding rostrum) 16 mm.; wing 16.5 mm.; rostrum alone 2.8–3 mm.

Three females in the typical series are so very different from the males, both in wing-pattern and leg-coloration, that it is difficult to believe that the two forms can represent merely the two sexes of a single species. Until more evidence is forthcoming, it seems best to apply a separate subspecific name to these females, but the possibility of this being a single very variable or highly dimorphic species is not excluded.

Characters as in typical *gemella*, differing as follows:—

Legs yellow or fulvous-yellow, the femora with a conspicuous black ring that is nearly terminal, the apex beyond it dark red; median portion of femora broadly infumated; tibial bases and tips infuscated; tarsal segments brownish yellow, the tips very narrowly infuscated, the terminal segments uniformly blackened. In a paratype female the legs are as in typical *gemella*, black, but the tips are narrowly but conspicuously reddish. Wings whitish subhyaline, with a handsome obliquely-banded brown pattern and ocellate rings at the origin of *Rs*, beyond the arculus and at the ends of veins *Cu*₁ to 2nd *A*; the outer oblique band includes the wing-tip, pale brown, margined internally with darker; the second band includes the outer brown spot of the stigma and the outer end of cell 1st *M*₂, pale, the margins narrowly darker; the third band is irregular and diffuse, at the cord, extending from the proximal end of the stigma to *m-cu*; anal region broadly suffused. One female has the wing-pattern more yellowish and very pale, approaching the type of the males of *gemella*.

Abdomen light yellowish brown, the caudal margins of the segments very narrowly ringed with yellowish, the lateral margins dark brown; basal tergite uniformly dark, pruinose. Ovipositor as described under the generic diagnosis.

Hab. Tasmania.

Holotype, ♀, Mt. Field, altitude 3500 feet, December 18, 1922 (*A. Tonnoir*).

Paratopotypes, 2 ♀ ♀, December 21, 1922.

Austrolimnophila relicta, sp. n.

Belongs to the *argus* group; general coloration brown; antennæ (♂) elongate; halteres elongate, the knobs yellow; femora with a narrow black terminal or nearly terminal ring that is preceded by a vague obscure yellow ring; wings with a yellowish tinge, sparsely spotted with brown; *m-cu* sinuous, oblique; male hypopygium with the inner margin of the gonapophyses microscopically serrulate.

Male.—Length 12 mm.; wing 14 mm.; antennæ about 6 mm.

Rostrum brown, obscure yellow laterally; palpi dark brown. Antennæ (δ) elongate, approximately one-half the length of the body, the segments elongate-cylindrical; first scapal segment dark brown; flagellar segments brown, darker outwardly, the incisures vaguely and narrowly paler; segments with a dense erect pubescence and short relatively inconspicuous verticils. Head brown, the centre of the vertex darker, the anterior vertex more yellowish.

Pronotum yellowish brown. Mesonotal præscutum with the restricted ground-colour brownish yellow to greyish with four dark brown stripes, the anterior and lateral margins of the sclerite in some specimens similarly margined with dark brown; scutum greyish brown, the centres of the lobes extensively dark brown; scutellum lighter brown, the parascutella darker; postnotum dark brown, very sparsely pruinose. Pleuræ yellowish brown, with a broad conspicuous dark brown longitudinal stripe extending from the cervical sclerites to the postnotum, passing between the wings and the halteres, the sternopleurite somewhat darkened. Halteres elongate, the stem pale, the outer third or less darker, the knobs yellow. Legs with the coxæ and trochanters obscure brownish yellow; femora brown, the bases paler, immediately before or at the tips with a narrow black ring, preceded by a very vague yellowish ring of slightly greater extent; remainder of legs brown with dark setæ, the terminal tarsal segments dark brown. Wings with a strong yellowish tinge, the base and costal region somewhat brighter; a sparse pattern of small brown spots distributed as follows: At h ; arcus; Sc_2 , base of R_{2+3} ; R_2 ; tips of veins R_{1+2} , R_3 and R_4 ; basal deflection of R_5 ; fork of M_{1+2} ; very vaguely on $m-cu$ and outer end of cell 1st M_2 ; gradually increasing marginal spots on the longitudinal veins from M_2 caudad; veins brown, more yellowish in the costal region. Venation: Sc_2 oblique, at tip of Sc_1 and exceeding the latter in length, ending shortly beyond origin of R_{2+3} ; Rs angulated and short-spurred at origin; R_2 very pale, some distance from the tip of R_{1+2} ; R_{2+3} a little shorter than the sinuous R_3 ; basal deflection of R_5 long, arcuated; cell M_1 about twice its petiole; cell 1st M_2 gently widened distally, the oblique, sinuous $m-cu$ placed at or before mid-length of its lower face; vein 2nd A long; anterior arcus broken.

Abdominal tergites brown, the lateral margins narrowly darker brown; hypopygium and subterminal segments dark; sternites obscure brownish yellow, their bases narrowly ringed with brown, on the outer segments the margins darker.

Male hypopygium with the ninth tergite evenly notched medially; basistyle short and stout, with long coarse setæ. Dististyle small, the outer style terminating in a slender curved hook. Gonapophyses appearing as flattened blades, the apex of each extended into a slender chitinized hook, the inner margin microscopically serrate.

Hab. Tasmania.

Holotype, ♂, Hartz Mts., December 10, 1922 (*A. Tonnoir*).

Paratypes, ♂, Mt. Farrel, February 8, 1923; ♂, Mt. Field, December 21, 1922; Adventure Bay, December 30, 1922 (*A. Tonnoir*).

The wings of the present species bear a conspicuous superficial resemblance to those of *Austrolimnophila intervena* (Skuse), but the coloration of the body and antennæ, and the venational details, are very different in the two species.

Epiphragma meridionalis, sp. n.

General coloration brown; antennæ relatively elongate, the flagellum bicolorous; pleura dark brown, narrowly lined with yellow; femora and tibiæ yellow, each with two brown rings; wings yellowish brown, with a sparse darker brown pattern, the spots ringed with paler; a single supernumerary cross-vein in cell *C*.

Male—Length 7.5–10 mm.; wing 8–10.8 mm.

Rostrum and palpi dark brown. Antennæ relatively elongate, if bent backward extending to shortly beyond the base of the halteres; first segment brown, sparsely pruinose; second and third segments orange; remaining flagellar segments brownish black, the apices of the segments light yellow, on the basal segments including about the distal third of the segment, the amount decreasing outwardly, the terminal segments more uniformly infuscated. Head brownish grey, variegated with brown.

Pronotum fulvous, the anterior notum with a small brown dash, the lateral margin of the sclerite infuscated. Mesonotal præscutum cinnamon-brown in front, variegated with dark brown along the cephalic margin and at the humeri, the extreme humeral angle obscure yellow; posterior portion of the præscutum more yellowish brown with four dark brown stripes that do not attain the suture; scutum obscure yellow, the lobes variegated with brown; remainder of mesonotum yellow, the postnotum greyish yellow, with a capillary brown vitta extending from the transverse suture to the abdomen; a small brown spot on either side of the scutellum at base; postnotum with a small brown spot on either side of the median vitta before mid-length. Pleura

largely dark brown, with two or three narrow and sometimes subobsolete obscure yellow longitudinal stripes, the dorso-pleural membrane dark brown. Halteres yellow, the basal half of the knobs brown, their apices yellow. || Legs with the fore coxæ yellow, traversed by two narrow brown lines; middle and hind coxæ yellow, the extreme bases dark brown; trochanters yellow; femora obscure yellow, with two broad brown rings, the first just beyond mid-length, the second narrower, subapical, the yellow ring enclosed being relatively broad, clearer yellow; tibiæ brownish yellow, clearer yellow at base, with a narrow dark brown subbasal ring and a broader more diffuse paler brown ring before mid-length; tip of tibiæ slightly darkened; tarsi brownish yellow, the last segment darker. Wings with a yellowish-brown tinge, with a sparse pattern of larger dark brown spots that are narrowly ringed with whitish subhyaline; these spots are arranged as follows: At *h*; arculus; origin of *Rs*; at supernumerary cross-vein in cell *C*; a broad oblique band extending from *Sc*₁ along the anterior cord to the fork of *M*; tip of *R*₁₊₂; *m-cu*; outer end of cell 1st *M*₂; fork of *M*₁₊₂; a continuous series of marginal spots at ends of longitudinal veins, these becoming larger posteriorly; anal angle narrowly darkened; veins pale brownish yellow, a little darker in the infuscated areas. Venation: A single supernumerary cross-vein in cell *C*; *Rs* square and spurred at origin; *R*₂ pale, subobsolete; *R*₂₊₃ longer than *R*₃; inner ends of cells *R*₄, *R*₅, and 1st *M*₂ in transverse alignment; cell *M*₁ one-half longer than its petiole; cell 1st *M*₂ long, widened outwardly, *m-cu* at one-third its length.

Abdominal tergites pale brown, the lateral margins narrowly darker; sternites yellow, the lateral margins of the segments narrowly dark brown, more extensively so on the basal sternites; hypopygium reddish brown to brown. Male hypopygium with the ninth tergite produced into a median lobe that is deeply notched, the lobes formed being relatively narrow. Inner dististyle longer than the outer, the apex flattened, obtusely rounded. Interbases slender, the apex terminating in two acute recurved spines.

Hab. Victoria, Tasmania.

Holotype, ♂, Strahan, Tasmania, February 5, 1923 (*A. Tonnoir*).

Paratopotype, ♂, February 1924 (*G. H. Hardy*), in Queensland University Collection; *paratypes*, 1 ♂, Tullah, Tasmania, November 8, 1922; 1 ♂, Zeehan, Tasmania, February 7, 1923; 3 ♂♂, Burnie, Tasmania, February 1, 1923 (*A. Tonnoir*); 1 ♂, Ferntree Gully, Victoria, February 22, 1924 (*G. F. Hill*), in National Museum, Victoria.

Epiphragma wilsoniana, sp. n.

General coloration brown; antennæ short, the flagellar segments beyond the second brownish black; femora and tibiæ yellow, the former with two brown rings, the latter with a darker brown subbasal ring; wings creamy subhyaline, the ground-colour almost obliterated by abundant spots and dots in all the cells; a series of about a dozen darker brown spots in cell *C*, these surrounding small spurs of cross-veins into the cell from vein *C*; petiole of cell *M*₁ short.

Male.—Length about 9.5 mm.; wing 10.5 mm.

Rostrum obscure yellow; palpi dark brown. Antennæ short, if bent backward scarcely attaining the wing-root; scapal segments brown, the basal segment slightly dusted, the second paler apically; basal flagellar segment orange-yellow; second flagellar segment brownish yellow; remainder of the flagellum brownish black, the segments with elongate verticils. Head yellowish brown, the vertex more greyish medially, with a brownish spot on either side.

Pronotum with the anterior sclerite fulvous, the postnotum obscure yellow. Lateral pretergites obscure yellow. Mesonotal præscutum with the usual stripes rather pale dull brown, the anterior portion and the usual interspaces and lateral margins deep chestnut-brown, the extreme cephalic margin of the sclerite narrowly blackened; humeral region restrictedly yellow; median line of the præscutum with a capillary brown vitta on the posterior half; scutum yellowish brown, the centres of the lobes extensively infuscated, the median area broadly darkened; scutellum dark, the surface pollinose, the median area dusky, with a conspicuous brown spot on either side at base; postnotum whitish, the median area with a brown line and with a brown spot on either side near mid-length. Pleura dark brown, very narrowly and vaguely lined longitudinally with yellow vittæ. Halteres yellow, the knobs infuscated. Legs with the fore coxæ dark brown, traversed by a yellowish line; remaining coxæ pale yellow, their bases narrowly dark brown; femora yellow with a brown subapical ring and a vague, sometimes scarcely defined, postmedial brown ring; tibiæ yellow, with a narrow but conspicuously dark brown subbasal ring; tips of tibiæ narrow and indistinctly infumed; tarsi yellow, the terminal segments darker. Wings creamy subhyaline, the ground-colour almost concealed by abundant brown spots and dots in all the cells, these so abundant as to be contiguous or confluent in most cases; a series of darker brown spots in

cell *C*, there being nine or ten between *h* and the super-numerary cross-vein, most of these spots encircling a short spur from costa into the cell; cell *Sc* nearly free from markings; the stigmal area and markings at ends of veins R_{1+2} , R_3 , and R_4 somewhat darker than the other spots of the membrane; veins pale brown. Costal fringe short. Venation: A series of spurs of veins in cell *C* as described above; Sc_2 longer than Sc_1 ; R_2 faint; R_{2+3} about one-half longer than R_3 alone; cell M_1 more than three times its petiole; cell 1st M_2 with the proximal end narrowed, the cell widened outwardly, *m-cu* at near two-thirds its length.

Abdominal tergites obscure yellow, the lateral margins broadly infuscated; sternites whitish yellow, the bases and lateral margins of the segments narrowly dark brown; hypopygium obscure yellow. Male hypopygium as in the other Australian species of the genus; tip of the outer dististyle a short hook, the margin of which is truncated. Interbases appearing as straight rods that terminate in two short curved teeth.

Hab. New South Wales.

Holotype, ♂, Mt. Wilson, Blue Mts., November 19, 1921 (*A. Tonnoir*).

BERGROTHOMYIA, gen. nov.

Antennæ 16-segmented; first scapal segment relatively short; basal flagellar segments with the lower face strongly protuberant and here unprovided with verticils; outermost flagellar segments passing into oval, with the lower face only slightly produced; outer face of the flagellar segments provided with verticils that are longer on the basal segments, where they are approximately one-half longer than the segments; surface of flagellar segments with a short, dense, erect pubescence. In the female the flagellar segments are somewhat less protuberant. Rostrum as long as the remainder of the head. Pronotum massive. Pseudosutural foveæ conspicuous, remote from the lateral margins of the præscutum; tuberculate pits present, placed at the extreme cephalic margin of the sclerite, separated from one another by a distance a little less than the diameter of one. Tibial spurs present. Wings with *Sc* relatively short, ending before the fork of *Rs*, Sc_2 close to the tip of Sc_1 ; *Rs* angulated and spurred at origin; R_{2+3+4} long (*diemenensis*) to very long (*rostrifera*); R_{2+3+4} a little shorter or longer than R_{3+4} (*rostrifera*) or R_4 longer than R_{2+3} (*diemenensis*); R_{1+2} a little longer than R_2 alone; inner ends of cells R_4 , R_5 , and

1st M_2 in transverse alignment; distal section of M_{1+2} in alignment with M_2 ; cell 1st M_2 large, $m-cu$ at or before mid-length; anterior arculus present. Male hypopygium with the basistyles relatively slender; outer dististyle small, terminating in an acute spine, the outer margin before the apex with numerous smaller appressed spines. Gonapophyses appearing as flattened plates on either side of the ædeagus, the tips produced into short recurved spines. Ovipositor with the valves long and slender, especially the very elongate, nearly straight tergal valves.

Genotype, *Limnophila rostrifera*, Skuse (Australian Sub-region).

Besides the genotype, the new species *Bergrothomyia diemenensis* belongs here. The other species of Hexatomine flies with the rostrum moderately elongate (*Rhamphophila*, Edwards, *Tonnoirella*, gen. nov.) belong to the subtribe Epiphragmaria, in which the anterior arculus is lacking. The present genus belongs to the subtribe Limnophilaria, with the anterior arculus preserved. The structure of the antennæ and male hypopygium, and the venation, especially the relative lengths of Sc and R_{2+3+4} and the position of R_2 , offer additional generic characters that point toward the genus *Pilaria*, Siutenis. This new genus is named in honour of the late Dr. Ewald Bergroth, distinguished Heteropterist and profound student of the Tipulidæ, to whom I express my most sincere thanks for much kindly advice in earlier years.

Bergrothomyia diemenensis, sp. n.

General coloration blue-grey, the præscutum with four brown stripes; wings whitish subhyaline, with a heavy brown pattern, cell Cu and the Anal cells washed with paler brown; R_2 at or beyond the fork of R_{3+4} , in rare cases placed shortly before this fork.

Male.—Length about 8 mm.; wing 7.8 mm.

Female.—Length about 11 mm.; wing 8.6 mm.

Rostrum light blue-grey; palpi dark brown. Antennæ one-half longer than the rostrum, black, the basal segment pruinose; flagellar segments as in the genus, the basal seven or eight flagellar segments strongly produced on the lower face. Head light blue-grey, with a conspicuous brown mark on the vertex.

Pronotum blue-grey. Mesonotal præscutum blue-grey with four brown stripes, the intermediate pair closely approximated, not reaching the suture; pseudosutural foveæ black; lateral margins of præscutum slightly infumed;

scutum blue-grey, the lobes very faintly marked with darker; scutellum and postnotum blue-grey. Pleura clear blue-grey, the dorso-pleural membrane narrowly buffy, suffused with brown behind. Halteres yellow, the knobs infuscated. Legs with the coxæ light brownish yellow, sparsely pruinose; trochanters obscure yellow, the tips infuscated; femora obscure yellow, the tips broadly blackened; tibiæ and basitarsi similar, the tips narrowly blackened; remaining segments of the tarsi passing into brownish black. Wings whitish subhyaline, with a heavy brown pattern; cell *C* yellowish brown to brown, with still darker clouds at *h* and the outer end; stigma oval, dark brown; conspicuous brown spots at origin of *Rs*; along the cord; fork of R_{2+3+4} ; outer end of cell 1st M_2 ; fork of M_{1+2} ; marginal spots on the longitudinal veins, large and conspicuous on R_3 , smaller on R_4 , the others very reduced; cell *M* largely suffused with paler brown; basal two-thirds of cell *Cu*, the end of cell 1st *A*, and the outer two-thirds of cell 2nd *A* similarly clouded; remaining veins in the caudal and outer parts of the wing more or less clouded with brown; veins brown, scarcely darker in the infuscated areas. Venation: Sc_2 at tip of Sc_1 ; *Rs* conspicuously spurred at origin; R_{2+3+4} long, but still much shorter than R_3 , nearly twice *m-cu*; R_{1+2} and R_2 subequal; R_2 subequal to R_{2+3} ; cell M_1 longer than to nearly twice its petiole; *m-cu* at one-third to shortly before mid-length of cell 1st M_2 ; cell 2nd *A* broad on basal half, narrowed apically. In a few cases R_2 is at or very close to the fork of R_{3+4} , in one paratype (Lake Margaret) before this fork, being subequal to R_{3+4} alone.

Abdomen dark greyish brown, the sternites paler, especially the basal sternites, which are obscure yellow; tergites with an oblique row of impressed dots on either side. Male hypopygium with the outer dististyle stout, the outer margin with conspicuous appressed to subappressed spines, these becoming smaller basally, but continued basad to beyond mid-length of the style. Gonapophyses with the spines long and slender, gently curved, the long tips acute.

Hab. Tasmania.

Holotype, ♂, Zeehan, February 1924 (*G. H. Hardy*), in Queensland University Collection.

Allotype, ♀, Strahan, February 1924 (*G. H. Hardy*).

Paratopotypes, 6 ♂ ♀; *paratypes*, 2 ♂ ♂, Lake Margaret February 3, 1923 (*A. Tonnoir*).

DIEMENOMYIA, gen. nov.

Antennæ with from 16 (*bulbosa*, sp. n., ♀) to 21 (*prætenuis*, sp. n.) segments; lower or ventral face of the flagellar segments strongly produced to give a serrate appearance to the organ; verticils relatively short and inconspicuous. Rostrum and palpi short. Pseudosutural foveæ small and inconspicuous, weakly lunate in form; tuberculate pits lacking; meron small. Tibiæ spurred. Wings with or without conspicuous macrotrichiae in the outer cells. Sc_1 elongate; R_2 about one-half R_{1+2} and subequal to nearly twice R_{2+3} ; inner ends of cells R_4 , R_5 , and 1st M_2 in transverse alignment; cell M_1 present; $m-cu$ about its own length beyond the fork of M ; anterior arculus preserved. Male hypopygium with the outer dististyle chitimized, weakly bifid at apex; inner dististyle smaller, fleshy. Gonapophyses appearing as flattened blades that terminate in a long recurved hook. Ovipositor with both tergal and sternal valves very long and nearly straight.

Genotype, *Diemenomyia bulbosa*, sp. n. (Australian Sub-region).

Diemenomyia prætenuis, sp. n., likewise belongs here. The characters of the group point toward *Tanymera* (Loew), Alexander (Lower Oligocene; Baltic Amber), in the produced flagellar segments, but in other respects the two genera do not seem to be very closely allied.

Diemenomyia bulbosa, sp. n.

General coloration grey; antennæ (♂) 18–20-segmented, in ♀ 16-segmented; lower face of flagellar segments strongly produced; wings tinged with brown, stigma dark brown.

Male.—Length about 6.5–7 mm.; wing 8–8.8 mm.

Female.—Length about 8 mm.; wing about 8.5 mm.

Rostrum dark; palpi dark brown. Antennæ (♂) 18–20-segmented, black throughout; basal and intermediate flagellar segments strongly produced, the terminal segments passing into oval; verticils moderately elongate, much exceeding the short dense pubescence. Head broad, dark brown, with a sparse yellowish pollen, heaviest in front.

Pronotum dark brown, dusted with yellowish grey. Mesonotal præscutum grey with three subconfluent brownish-black stripes that are more sparsely dusted and appear somewhat shiny; scutum and scutellum dark brown, sparsely pollinose; postnotum heavily dusted. Pleura dark brown, with a sparse greyish pollen. Halteres yellow. Legs with

the coxæ brownish yellow, fore coxæ darker; trochanters obscure yellow; femora brownish black, their bases broadly obscure yellow; tibiae and tarsi brownish black. Wings with a strong brownish tinge, the costal region somewhat darker; stigma oval, dark brown; a dusky cloud on the anterior cord; vein Cu_1 more or less distinctly seamed with dusky; veins dark brown. Macrotrichiae in the apices of cells R_2 , R_3 , R_4 , R_5 , 2nd M_2 , M_3 , and, in cases, even M_4 and all of M_1 . Venation: Sc_1 extending just beyond the fork of Rs , Sc_2 some distance from its tip, variable in position, Sc_1 ranging from a little less than to much exceeding $m-cu$; R_2 about one-half R_{1+2} and subequal to R_{2+3} ; R_{2+3+4} about one-third longer than $m-cu$; cell M_1 present, varying from a little more than one-half to fully as long as its petiole; $m-cu$ varying from a distance equal to its own length to slightly less beyond the fork of M .

Abdomen dark brown, including the hypopygium. Male hypopygium with the basistyle stout. Outer dististyle relatively slender, heavily blackened, more thickened basally, narrowed to the slightly bifid apex; surface of style with long yellow setae, especially on the outer face; inner style shorter, with basal setae, the apex narrowed, smooth, terminating in a single strong seta. Gonapophyses terminating in a strong hook at the caudo-lateral angle, this directed strongly mesad. Edeagus elongate.

In the female the antennae are only 16-segmented, the segments but slightly produced, the terminal segment much larger than the penultimate. Macrotrichiae of the wing more restricted, confined to the radial field. Ovipositor with the valves long and straight, the tips acute.

Hab. Tasmania.

Holotype, ♂, Mt. Wellington, November 28, 1922 (*A. Tonnoir*).

Allotopotype, ♀, November 30, 1922.

Paratopotypes, 5 ♂ ♀, November 26–30, 1922; *paratypes*, 2 ♂ ♂, Hartz Mts., December 9–10, 1922; ♂ ♂, Cradle Valley, January 10–27, 1923 (*A. Tonnoir*).

Diemenomyia bulbosa multifida, subsp. n.

Female.—Length about 7 mm.; wing 8 mm.

Resembling the typical form, differing as follows:—

Antennae, ♀, 18-segmented, feebly serrate. General coloration of head and thorax strongly blue-grey pruinose. Pseudosutural foveae lying close to the lateral margin of praescutum. Wings without macrotrichiae in the cells.

Hab. Tasmania.

Holotype, ♀, Cradle Valley, January 22, 1923 (*A. Tonnoir*).

Diemenomyia bulbosa temeraria, subsp. n.

Male.—Length 4.5–5 mm.; wing 5–6 mm.

Resembling the typical form, differing as follows:—

A very small fly, with 18-segmented antennæ; macrotrichiæ either completely lacking (holotype) or weakly preserved (paratype). Sc_2 removed from tip of Sc_1 , the latter a little less than $m-cu$; R_2 subequal to R_{1+2} and R_{2+3} ; cell M_1 very small.

Hab. Tasmania.

Holotype, ♂, Cradle Valley, January 27, 1893 (*A. Tonnoir*).

Paratopotype, ♂.

Diemenomyia prætenuis, sp. n.

Male.—Length about 6.5 mm.; wing 6.8–7.2 mm.; antennæ about 3.8 mm.

Closely allied to *D. bulbosa*, sp. n. Antennæ 21-segmented, very long and slender, if bent backward extending to nearly one-third the length of the abdomen; antennæ black throughout, the scapal segments slightly pruinose; flagellar segments long, moderately produced beneath, the appearance produced not markedly serrate; individual flagellar segments densely clothed with a short dense pubescence, the verticils short, scarcely longer than the pile. Wings with a brown tinge, the stigma relatively pale, not darker than the vague seam on the anterior cord and but little evident against the ground-colour; veins darker brown. Macrotrichiæ of the cells very scanty, confined to cells R_3 , R_4 , and R_5 , in the two latter cells restricted to a single row at or near mid-width of the cells, confined to the distal half or less.

Hab. Tasmania.

Holotype, ♂, Mt. Field, December 18, 1922 (*A. Tonnoir*).

Paratopotype, ♂.

Limnophila cingulipes, sp. n.

General coloration grey, the præscutum with brown stripes; antennæ short, obscure yellow, the basal segment dark; femora yellow, with two narrow dark rings; wings relatively narrow, whitish, with a heavy brown pattern; cell 1st M_2 elongate; $m-cu$ at near mid-length.

Male.—Length about 13 mm.; wing 12.5 mm.

Rostrum brown, with a sparse grey bloom, the nasal region tufted with a few dark setæ. Antennæ relatively short, if bent backward not attaining the wing-root; basal segment elongate-cylindrical, dark brown; remainder of antennæ obscure yellow, the flagellar segments long-oval, becoming smaller and somewhat darker outwardly. Head dark, heavily grey pruinose.

Pronotum light grey, the median area with an interrupted brown line. Mesonotal præscutum light grey, with three brown stripes, the median stripe very pale brown, its anterior half divided by a very conspicuous dark brown capillary vitta; lateral stripes broad, dark brown, extending from behind the large circular pseudosutural foveæ to the suture; foveæ pale reddish; lateral margins of præscutum weakly infumed; scutum light grey, each lobe with a large mesal and a very small lateral spot of dark brown; scutellum grey, the parascutella darker; postnotal mediotergite grey, darker caudally and laterally. Pleura grey, with a broad dark brown stripe, extending from the pronotum across the dorsal pleurites, passing above the halteres and beneath the wing-root; dorso-pleural membrane obscure yellow. Halteres pale, the knobs weakly darker. Legs with the coxæ dark brown, sparsely pruinose, especially the hind coxæ; trochanters brownish yellow; legs long and slender, femora yellow, with a broad subterminal blackish ring and a narrower similar postmedial ring, the two enclosing a broad obscure yellow annulus; extreme tip of femora pale; tibiæ obscure yellow, the extreme base and the tips darkened; tarsi brownish yellow, the tips of the individual segments infuscated, the terminal segment uniformly dark. Wings relatively narrow, whitish, with a heavy brown pattern, including a prearcular mark that also includes the extreme base of cell *R*; a large spot at origin of *Rs* that does not reach vein *M*; a somewhat smaller spot at mid-distance between areculus and origin of *Rs* that reaches *M*; a small circular spot at *Sc*₂; stigma oval, confluent with extensive brown areas on the anterior cord; a large spot at end of vein *R*₃, completely crossing cell *R*₃; smaller spots at the ends of the longitudinal veins; outer end of cell 1st *M*₂, fork of *M*₁₊₂, and on *m-cu*, the latter broader; brown washes occupy cell *M* except at outer end and cell *M*₄ except the narrowed cephalic portion; other brown washes in the basal half of cell *Cu*, distal third of cell *R*₅, near outer end of cell 1st *A*, beyond mid-length of cell 2nd *A*, and the margin from this latter mark outward to vein *Cu*₁; anal angle vaguely darkened; wing-base and cells *C*, *Sc*, and much of *Sc*₁

yellowish; veins dark in the infuscated areas, more yellowish in the pale areas. Macrotrichia of the veins sparse, there being none on R_s , R_{2+3+4} , R_{2+3} , or R_3 ; trichia present on R_4 , R_5 , M_1 , M_2 , and the extreme outer end of M_3 . Venation: Sc_2 some distance from the tip of Sc_1 , the latter alone longer than $m-cu$; R_s long, angulated at origin, in alignment with R_{2+3+4} ; cell R_3 deep, the veins diverging at ends; R_2 about two-fifths of R_{1+2} and one-half or more of R_{2+3} ; $r-m$ very short; cell 1st M_2 long and narrow, rectangular; cell M_1 more than twice its petiole; $m-cu$ near mid-length of cell 1st M_2 ; vein 2nd A elongate, gently sinuous; anterior arculus present.

Abdominal tergites brown, paler brown medially, the lateral margins darker brown to form longitudinal stripes; hypopygium dark; sternites reddish brown, the lateral margins and caudal margin of sternite 2 darker brown. Male hypopygium with the basistyles relatively slender. Dististyles two, the outer style nearly straight, slender, narrowed to the simple acute blackened apex; inner style very broad and flattened, with a more chitinated outer margin that is densely provided with microscopic erect setulae, the outer margin of the style with long coarse setae. Aedeagus constricted before the tip, subtended on either side by acute gonapophyses.

Hab. Tasmania.

Holotype, ♂, Cradle Valley, January 10, 1923 (*A. Tonnoir*).

Limnophila mirabunda, sp. n.

General coloration yellowish grey, the præscutum with three conspicuous brownish-black stripes; antennæ (♂) short; halteres entirely pale yellow; legs yellow, the tips of the femora abruptly blackened; tips of the tibiae and the segments of the tarsi narrowly blackened; wings tinged with yellow, the prearcular region brighter, the disk with conspicuous brown spots; male hypopygium with the aedeagus long and slender.

Male.—Length about 11 mm.; wing 12 mm.

Rostrum dark, with a yellowish bloom; palpi brownish black. Antennæ short, if bent backward ending far before the wing-root; first segment brown, sparsely pruinose; flagellar segments brownish black; basal three segments of the flagellum subglobular, the first largest, the others gradually smaller; fourth flagellar segment a little bulging; remaining segments elongate-cylindrical, the verticils near

mid-length, these latter long, unilaterally arranged and exceeding the segments in length. Head strongly narrowed behind, greyish in front, more yellowish grey behind, the centre of the vertex extensively infuscated.

Pronotum brownish grey. Mesonotal præscutum greyish yellow, with three conspicuous brownish-black stripes, the median stripe very vaguely divided by a more reddish-brown line, the stripe a little constricted at the pseudosutural foveæ, widened behind, not attaining the suture; pseudosutural foveæ irregularly oval, black; tuberculate pits not evident; scutum grey, each lobe with two confluent brownish-black spots; scutellum broad, grey, the parascutella very small, dark; postnotal mediotergite dark brown, with a basal grey triangle, the point directed caudad. Pleura dark, the surface heavily grey pruinose, the dorso-pleural membrane buffy. Halteres entirely pale yellow. Legs with the coxæ dark brown, the posterior coxæ paler apically, all coxæ heavily pruinose; trochanters obscure yellow; femora yellow, the tips abruptly and rather narrowly but conspicuously blackened; tibiæ yellow, the extreme bases and broader tips blackened; basal three tarsal segments obscure yellow to brownish yellow, the tips narrowly blackened; terminal tarsal segments black; segments of legs with long, conspicuous, suberect setæ. Wings with a strong yellowish tinge, the prearcular region brighter yellow; cell *C* dull yellow, cell *Sc* similar, the distal portion a trifle more infumed; conspicuous brown spots and washes arranged as follows: Postarcular, in cells *R* and *M*; at origin of *Rs*, barely reaching *M*; stigma oval, confluent with a broad seam at the cord; outer end of cell 1st *M*₂; spots at fork of *M*₁₊₂ and marginal spots at ends of veins *R*₃, *R*₄, *M*₃, *Cu*₁, and 2nd *A*; paler brown washes along veins *M* and *Cu*, suffusing the middle of cell *M*, basal half of *Cu*, outer end of 1st *A* opposite the end of vein 2nd *A*, the anal angle of the wing, and near mid-length of cell 2nd *A*; veins dark brown, more yellowish in the prearcular region and the clear areas on *Rs*; one wing of the type shows a brown spot in cell *R*₁ at mid-length of *Rs*. No macrotrichiae on veins *R*₃, *R*₂₊₃, *R*₂₊₃₊₄, or *Rs*; numerous trichiae on distal two-thirds of *R*₁. Venation: *Sc* long, *Sc*₁ ending just beyond the fork of *Rs*, *Sc*₂ at its extreme tip; *Rs* long, shortly angulated and weakly spurred at origin; *R*₂₊₃₊₄ longer than *m-cu*; veins *R*₃ and *R*₄ divergent, the former relatively short; *R*₂ about two-thirds *R*₁₊₂ and twice as long as *R*₂₊₃; inner ends of cells *R*₄, *R*₅, and 1st *M*₂ in alignment; cell *M*₁

a trifle longer than its petiole; cell 1st M_2 small, $m-cu$ close to mid-length; anterior arculus present.

Abdomen dark brown, sparsely pruinose; lateral margins of the tergites narrowly ochreous; hopopygium a little paler. Male hypopygium with the basistyles rather slender, the outer face with long, coarse, erect setæ. Outer dististyle a flattened black blade that is gradually widened outwardly, the outer apical angle terminating in an acute curved hook, the surface of the style beyond the base with long, conspicuous, subappressed setæ. Inner dististyle shorter, darkened, the outer surface with numerous setæ, the apex terminating in two powerful bristles. Gonapophyses appearing as slender, strongly-curved hooks. Ædeagus very long and slender.

Hab. Tasmania.

Holotype, ♂, Geeveston, December 8, 1922 (*A. Tonnoir*).

Limnophila fundata, sp. n.

Belongs to the *fundata* group; general coloration brownish yellow; centre of vertex shiny black; antennæ short; halteres pale; wings with a pale brown tinge; Sc long, Sc_2 at tip of Sc_1 ; cell M_1 lacking; sparse macrotrichia in ends of cells R_4 and R_5 ; male hypopygium with the outer dististyle slender, bifid at apex; gonapophyses appearing as a semi-circlet of chitinized spines surrounding the ædeagus.

Male.—Length about 5.3–5.6 mm.; wing 6.3–7 mm.

Rostrum and palpi brown. Antennæ short, if bent backward not extending far beyond the pronotum; scapal segments brown, the basal segments of the flagellum light brown, the terminal segments somewhat darker; flagellar segments oval, with verticils that are much longer than the segments; terminal segments more elongate. Head shiny black, dusted with yellowish grey, the centre of the vertex polished black.

Pronotum brown to brownish black, the posterior portion yellowish. Mesonotum obscure yellow, the præscutum pollinose, with three brown to dark brown stripes that are subconfluent; pseudosutural foveæ and tuberculate pits not evident; præscutal setæ small; scutal lobes infuscated, sparsely pollinose; scutellum broad, testaceous yellow; postnotum brown, with a sparse pale pollen. Pleura pale brown, with indications of darker brown markings on the pteropleurite and sternopleurite. Halteres pale, relatively short. Legs with the coxæ and trochanters brownish testaceous; remainder of legs pale brown, the terminal tarsal segments darker; tibial spurs small. Wings with a pale

brown tinge, the stigma only slightly darker; veins dark brown. Sparse macrotrichiae in the apices of cells R_4 and R_5 . Venation: Sc_1 long, extending to opposite one-third the length of R_{2+3+4} , Sc_2 about its own length from the tip and likewise beyond the fork of R_s ; R_s arcuated at origin, in alignment with R_{2+3+4} ; R_2 about two-fifths R_{1+2} and one-half R_{2+3} ; inner ends of cells R_4 , R_5 , and 1st M_2 in alignment; cell M_1 lacking; veins beyond cell 1st M_2 elongate; $m-cu$ less than its length beyond the fork of M ; anterior arculus present.

Abdomen brown, the basal sternites somewhat paler; hypopygium yellow. Male hypopygium with the basistyles elongate, with conspicuous setae on outer face and at apex. Two dististyles, the outer long and slender, strongly curved, the apex bifid, the distal half with conspicuous setae; at base with a small lobule; inner style shorter, the basal portion with conspicuous setae. Gonapophyses in the form of a conspicuous flattened plate, the mesal margin with several conspicuous spines. Penis very long, sinuous within the aedeagus.

Hab. Tasmania.

Holotype, ♂, Cradle Valley, January 14, 1923 (*A. Tonnoir*).

Paratopotype, ♂, January 13, 1923; *paratype*, ♂, King River, February 4, 1923 (*A. Tonnoir*).

Limnophila nitidiceps, sp. n.

Belongs to the *fundata* group; general coloration yellow, the præscutum with a median black stripe; pleura brownish yellow; antennae elongate; legs black, the femoral bases paler; wings with a faint brown tinge; macrotrichiae in ends of cells R_4 and R_5 ; cell M_1 lacking.

Male.—Length about 4.6 mm.; wing 5.8–6 mm.

Female.—Length about 5.5 mm.; wing 6.2–6.7 mm.

Rostrum and palpi dark brown. Antennae (♂) elongate for a member of the group, if bent backward extending to some distance beyond the wing-root; black throughout; flagellar segments elongate-cylindrical to fusiform, the verticils a little shorter than the segments. In the female the antennae are a little shorter but still longer than in either sex of the other members of the group (*fundata*, sp. n.; *morula*, sp. n.). Head grey, the vertex extensively shiny polished black.

Pronotum dark brown, paler laterally, the posterior notum yellow. Mesonotal præscutum yellow with a conspicuous median black stripe and less conspicuous brown lateral

stripes, the interspaces obscured, with a sparse yellow pollen; pseudosutural foveæ faint and pale in colour; tuberculate pits lacking; scutal lobes infuscated anteriorly, the median area and remainder of the lobes yellowish; scutellum and postnotum brownish yellow. Pleura brownish yellow. Halteres relatively elongate, the knobs weakly infuscated. Legs with the coxæ yellow, the fore coxæ a little infuscated; trochanters yellow; femora dark brownish black, the bases narrowly obscure yellow; tibiæ and tarsi brownish black. Wings with a faint brownish tinge, the stigma pale, ill-defined; veins darker brown. Sparse macrotrichiæ in apices of cells R_4 and R_5 . Venation: Sc_1 ending shortly before the fork of R_s , Sc_2 varying in position, from a little more than its own length to about twice its own length from the tip; R_s rather strongly angulated at origin; R_2 approximately one-half or less R_{1+2} and one-half or more R_{2+3} ; veins R_3 and R_4 strongly divergent, R_3 sinuous, bent strongly toward R_{1+2} at tip, markedly narrowing cell R_2 ; inner ends of cells R_4 , R_5 , and 1st M_2 in alignment; cell M_1 lacking; $m-cu$ less than its own length beyond the fork of M .

Abdominal tergites dark brown, the basal sternites conspicuously yellow; hypopygium yellowish. Male hypopygium as in *fundata*, the gonapophyses of different shape, appearing as two opposable many-toothed combs. Ovipositor with the valves elongate, nearly straight, the tergal valves gently upcurved.

Hab. Tasmania.

Holotype, ♂, Eaglehawk Neck, Tasman Peninsula, November 18, 1922 (*A. Tonnoir*).

Allotopotype, ♀, November 23, 1922.

Paratopotypes, 2 ♀ ♀, November 25–30, 1922 (*A. Tonnoir*).

Limnophila morula, sp. n.

Belongs to the *fundata* group; general coloration grey, the præscutum with three shiny brownish-black stripes; pleura heavily pruinose; antennæ short; tips of femora narrowly infuscated; wings with a faint brown tinge, the stigma darker; sparse macrotrichiæ in the ends of the radial cells; cell M_1 lacking.

Male.—Length about 5.3 mm.; wing 6.6 mm.

Female.—Length about 6.3 mm.; wing 7.3 mm.

Rostrum and palpi brown. Antennæ of moderate length, in male if bent backward extending to shortly before the wing-root; basal segment of scape a trifle paler than the remainder of the organ; flagellar segments short, basal ones

globular, passing into oval; verticils longer than the segments. Head clear light grey, the centre of the vertex extensively polished black.

Pronotum dark brown, heavily grey pruinose. Mesonotal præscutum grey, with three shiny brownish-black stripes; scutellum and postnotum passing into clear light grey. Pleura light grey. Halteres pale. Legs with the fore coxæ dark brown, sparsely pruinose; remaining coxæ obscure yellow, the bases infuscated; trochanters obscure yellow; femora obscure brownish yellow, the tips infuscated; tibiæ brown; tarsi passing into dark brown. Wings with a faint brown tinge, the stigma darker brown; veins darker brown. Very sparse macrotrichiæ in the apices of cells R_3 , R_4 , and R_5 , in cases lacking in one or another of these cells. Venation: Sc relatively short, Sc_1 ending about opposite four-fifths the length of R_3 , Sc_2 variable in position, in some specimens retreated back from the apex, in others not far from the tip of Sc_1 ; veins R_3 and R_4 strongly divergent, cell R_2 being generally parallel-sided; cell M_1 lacking; $m-cu$ its own length or less beyond the fork of M .

Abdomen dark brown, sparsely pruinose; hypopygium yellowish. Male hypopygium almost exactly as in *L. fundata*, the gonapophyses with the spines relatively fewer and larger, the apophyses not formed into flattened blades.

Hab. Tasmania.

Holotype, ♂, St. Patrick River, November 4, 1922 (*A. Tonnoir*).

Allotopotype, ♀, October 30, 1922.

Paratypes, ♀, Geeveston, December 8, 1922; ♀, Cradle Valley, January 26, 1923; ♀, Mt. Field, December 18, 1922; ♀, Eaglehawk Neck, November 15, 1922 (*A. Tonnoir*).

Limnophila referta, sp. n.

Belongs to the *pilosipennis* group; general coloration dark brown, with a sparse yellow pollen; antennæ (♂) elongate, the flagellar segments with the lower face slightly protuberant, the verticils a little shorter than the segments; wings with the stigma oval, brown; distal cells of wing with macrotrichiæ; cell M_1 present; Sc_2 near the tip of Sc_1 ; male hypopygium with the ædeagus elongate.

Male.—Length about 5.6 mm.; wing 7.2 mm.

Female.—Length about 6.5 mm.; wing about 6.8 mm.

Rostrum and palpi brown. Antennæ 16-segmented, elongate, if bent backward extending about to the base of the abdomen, dark brown throughout; flagellar segments

elongate-fusiform, the lower face of each segment a little more bulging than the upper; verticils a little shorter than the segments. Head dark brown, with a sparse yellow pollen.

Pronotum dark brown, sparsely pruinose. Mesonotal præscutum dark brown, subnitidous, with a sparse yellow pollen, more evident laterally, without distinct stripes; pseudosutural foveæ black, lying longitudinally close to the lateral margin; no tuberculate pits; scutal lobes dark brown, the median area and scutellum somewhat paler; postnotum dark brown, pruinose. Pleura pruinose. Halteres yellow, the knobs weakly darkened. Legs with the coxæ elongate, yellow, their bases infuscated, especially the fore coxæ; trochanters yellow; femora obscure yellow, the tips extensively infuscated; tibiæ light brown, the tips narrowly darkened; tarsi passing into dark brown. Wings with a faint dusky tinge, the stigma oval, brown; a very vague infuscation on the anterior cord; veins dark brown. Very sparse macrotrichia in apices of cells R_3 to M_3 inclusive. In the female these trichia are restricted to cells R_4 and R_5 . Venation: Sc_1 ending immediately below the fork of R_s , Sc_2 a little more than its own length from the tip; R_2 one-half to two-thirds R_{1+2} and R_{2+3} ; inner ends of cells R_4 , R_5 , and 1st M_2 in alignment; cell M_1 present, from one-half to two-thirds its petiole; *m-cu* about its own length beyond the fork of M .

Abdomen dark brown, the basal sternites paler brown; hypopygium obscure brownish yellow, the apices of the basistyles and the dististyles darkened. Male hypopygium with the basistyles narrowed outwardly; interbasal process slender, gently arcuated, dilated near mid-length, the distal half slender, curved. Dististyles small, connected basally by membrane; outer dististyle narrowed to the bifid tip, the surface with erect setæ; inner dististyle with numerous setæ on the fleshy basal portion. Phallosome complex, the ædeagus very long. Ninth tergite with a broad U-shaped caudal notch, the small lateral lobes formed blunt, weakly infuscated.

Hab. Tasmania.

Holotype, ♂, Mt. Wellington, November 25, 1922 (*A. Tonnoir*).

Allotype, ♀, Hartz Mts., December 10, 1922.

Paratopotype, ♂, November 30, 1922; *paratype*, ♀, Eaglehawk Neck, November 18, 1922 (*A. Tonnoir*).

Limnophila subcylindrica, sp. n.

Belongs to the *pilosipennis* group; general coloration reddish brown; antennæ elongate, if bent backward extending to shortly beyond the base of the abdomen, black, the second scapal segment usually paler; flagellar segments elongate, subcylindrical, a little narrowed at the ends; segments with verticils that are only about one-half the length of the segments themselves and with a conspicuous erect pale pubescence. Head dark brown, with a conspicuous yellow pollen.

Pronotum dark brown, with a sparse yellow pollen. Mesonotum reddish brown, without distinct stripes; scutellum darker brown; pseudosutural foveæ not evident; præscutal setæ small, erect. Pleura yellowish brown, the dorsal pleurites more infuscated. Halteres pale, the knobs weakly infuscated. Legs with the coxæ and trochanters brownish yellow; femora dark brown, the bases narrowly paler; tibiæ and tarsi brownish black. Wings with a strong brownish-yellow tinge; stigma conspicuous, oval, dark brown; pale brown seams at origin of R_s , along cord and outer end of cell 1st M_2 ; veins Cu_1 and Cu_2 margined with brown; veins dark brown, with conspicuous bullate areas along the cord and on the outer deflection of M_3 . Macrotrichæ in the cells of the wing beyond the cord, including all but the bases of the cells; stigma setiferous. Venation: Sc_1 ending just beyond the fork of R_s , Sc_1 from two to three times Sc_2 and varying from shorter to a little longer than $m-cu$; R_s in alignment with R_{2+3+4} , the latter about equal to or a trifle longer than the basal deflection of R_5 ; R_2 subequal to R_{1+2} , R_{2+3} about one-third R_3 ; inner ends of cells R_4 , R_5 , and 1st M_2 in approximate alignment; cell M_1 present, a little shorter than its petiole; $m-cu$ before mid-length of cell 1st M_2 ; anterior arcus present.

Abdomen dark brown, the caudo-medial region of the tergites paler to produce an indistinct bicolorous effect; basal sternites obscure yellowish, the lateral margins conspicuously blackened; subterminal segments more uniformly darkened; hypopygium reddish brown. Male hypopygium with the basistyles moderately stout, each with a conspicuous interbasal process, these appearing as curved yellow blades. Outer dististyle relatively slender, entirely blackened, narrowed to the apex, which is only microscopically bifid; style with conspicuous erect setæ. Inner dististyle connected with the outer by membrane, and about one-half its length,

enlarged at base, the apex narrowed, the surface with conspicuous erect setæ. *Ædeagus* projecting far beyond the straight gonapophyses. Ninth tergite with the caudal margin having a broad U-shaped notch.

Hab. Tasmania.

Holotype, ♂, Cradle Valley, January 27, 1923 (*A. Tonnoir*).

Paratopotypes, 2 ♂♂, January 23, 1923 (*A. Tonnoir*).

Limnophila novella, sp. n.

Belongs to the *pilosipennis* group; general coloration black, sparsely yellowish to grey pollinose; antennæ elongate, black throughout; halteres yellow, the knobs weakly infuscated; legs largely brownish black; wings tinged with brown, the stigma conspicuous, oval; macrotrichiæ in cells R_3 to M_3 ; cell M_1 lacking; male hypopygium with the caudal margin of the ninth tergite conspicuously notched medially.

Male.—Length 5.2–5.5 mm.; wing 6.3–6.8 mm.

Female.—Length about 5.3 mm.; wing about 6 mm.

Rostrum and palpi black. Antennæ elongate, black throughout, if bent backward extending to some distance beyond the base of the abdomen; flagellar segments subcylindrical to elongate-fusiform, with short verticils and a dense erect pubescence. Head dark brown, light grey pruinose.

Pronotum and mesonotum black, the colour obscured by a sparse yellow to greyish pollen; pseudosutural foveæ small and indistinct, lying close to the margin. Pleura dark, sparsely grey pruinose. Halteres moderately elongate, pale yellow, the knobs weakly infuscated. Legs with the coxæ dark, the posterior coxæ paler, all coxæ more or less pruinose; trochanters yellowish brown; remainder of legs brownish black, the femoral bases restrictedly obscure yellow. Wings with a brownish tinge, the stigma conspicuous, oval, dark brown; brown seams at origin of R_s , along the cord and outer end of cell 1st M_2 ; paler washes in outer end of cell R and in the base of cell 1st A ; veins dark brown. Small and sparse macrotrichiæ in cells R_3 , R_4 , R_5 , 2nd M_2 , and M_3 , these occupying approximately the distal half or more of each cell. Venation: Sc_1 ending about opposite the fork of R_s , Sc_2 not far from its tip, Sc_1 being equal to or shorter than $m-cu$; R_2 near mid-length of the stigma, a little shorter than R_{1+2} and from one-half to subequal to R_{2+3} ; inner ends of cells R_4 , R_5 , and 1st M_2 in

transverse alignment; cell M_1 lacking; $m-cu$ from one-half to nearly its own length beyond the fork of M ; anterior arculus preserved.

Abdomen brownish black, the hypopygium dark. Male hypopygium with the basistyles relatively stout; interbasal process bifid at apex. Outer dististyle relatively short, blackened, the apex bifid; inner style shorter, the base setiferous, the tip dusky, with microscopic setulae and an elongate subterminal seta. Aedeagus elongate, extending caudad to the level of the apices of the basistyles. Ninth tergite with the caudal margin having a deep U-shaped notch, each lateral angle of which is slightly produced into a lobe.

Hab. Tasmania.

Holotype, ♂, Hartz Mts., December 10, 1922 (*A. Tonnoir*).

Allotype, ♀.

Paratopotypes, 3 ♂ ♂.

Limnophila egena, sp. n.

Belongs to the *pilosipennis* group; general coloration light testaceous brown; pleura yellow; antennae (♂) extending to beyond the base of abdomen; wings uniformly pale brown, the stigma oval, slightly darker brown; R_{2+3+4} short; cell M_1 lacking; sparse macrotrichiae in the apical cells of the wing.

Male.—Length about 4.4–4.5 mm.; wing 5.2–5.5 mm.

Female.—Length about 4.3 mm.; wing 5.3 mm.

Rostrum brown, the palpi dark brown. Antennae (♂) relatively long and slender, if bent backward extending to shortly beyond the base of the abdomen; flagellar segments subcylindrical to elongate-fusiform; verticils shorter than the segments; segments clothed with a conspicuous erect pubescence. Head shiny brownish black with a sparse pruinosity.

Mesonotum light testaceous brown, without markings, the scutellum darker brown. Pleura testaceous yellow. Halteres long and slender, pale, the knobs weakly infuscated. Legs with the coxae obscure yellow; trochanters testaceous yellow; remainder of legs dark brown, the femoral bases narrowly paler. Wings with a pale brown tinge, the stigma oval, pale, slightly darker brown than the ground-colour; veins dark brown. Macrotrichiae in the distal half of each of cells R_3 , R_4 , R_5 , 2nd M_2 , and M_3 ; stigma without trichiae. Venation: Sc_1 ending shortly beyond the fork of Rs , Sc_2 some distance from its tip, Sc_1 alone being longer than $m-cu$; Rs long, arcuated at origin; R_2 subequal or a little shorter than

R_{1+2} ; R_{2+3} a little shorter than R_3 alone; R_{2+3+4} shorter than the basal deflection of R_5 ; cell M_1 lacking; cell 1st M_2 small, with $m-cu$ before or near mid-length.

Abdominal tergites dark brown, the basal sternites paler; hypopygium yellowish brown. Male hypopygium with the basistyles relatively slender, with a conspicuous interbasal process, this latter chitinized, cylindrical, with a few small denticles at and before apex. Outer dististyle blackened, slender, curved, gradually narrowed to the simple apex, the surface with scattered setæ; inner dististyle about two-thirds the length of the outer, pale, the basal portion dilated and with conspicuous erect setæ, the distal third narrowed and provided with two apical setæ. Gonapophyses darkened, each apophysis appearing as an arcuated rod, the apical half directed laterad and caudad, narrowed to an acute point. Aedeagus bifid at apex. Ninth tergite with a broad U-shaped notch.

Hab. Victoria.

Holotype, ♂, Sassafras, Dandenong Range, October 20, 1922 (*A. Tonnoir*).

Allotopotype, ♀, in copula with the type.

Paratopotypes, ♂ ♀, October 19–21 (*A. Tonnoir*).

Limnophila subapterogyne, sp. n.

General coloration dark brown; nearly apterous, at least in the female sex, the wings only twice the length of the reduced halteres.

Female.—Length about 4 mm.; wing 0.5 mm.

Rostrum and palpi dark brown. Antennæ 16-segmented, of moderate length, if bent backward extending approximately to the wing-root, dark brown throughout; flagellar segments oval, the outer segments more elongate-oval. Head black, very sparsely pollinose.

Pronotum and mesonotum dark brown; mesonotum moderately depressed. Pleura brown, sparsely pollinose. Halteres reduced, obscure brownish yellow at base, the remainder dark brown. Legs with the coxæ elongate, especially the middle and hind coxæ, dark brown, very sparsely pruinose; trochanters dark brown, the fore trochanters a little brighter; remainder of legs yellowish brown, the tarsi passing into dark brown. Wings greatly reduced in size, only about twice the length of the halteres, dusky in colour, without distinct venation.

Abdomen elongate, dark brown. Ovipositor with the

valves very long and slender, the tergal valves gently up-curved to the acute tips, light horn-coloured, the sternal valves straight, blackened.

Hab. Tasmania.

Holotype, ♀, Hartz Mts., December 10, 1922 (*A. Tonnoir*).

The only species to which the present fly could possibly be referred is *Limnophila novella*, sp. n., with which a fully-winged female has already been associated, perhaps erroneously. Subapterism in the genus *Limnophila* usually involves both sexes, and it is very possible that the male of the present species is likewise subapterous.

VI — *Spirifer pennystonensis*, sp. n., from the Coal Measures of Coalbrookdale. By T. NEVILLE GEORGE, M.Sc., Fellow of the University of Wales, St. John's College, Cambridge.

[Plate IV.]

WHILE studying the Coal Measures of the Coalbrookdale Coalfield, Prestwich* discovered a remarkable marine bed at the horizon of the Pennystone Ironstone, which contained a species of *Spirifer*†. This form was briefly described in a palæontological appendix by J. de C. Sowerby, who included it in the species *S. bisulcatus*, Sowerby‡. Following him, several geologists have recorded *S. bisulcatus* from Coalbrookdale§, without, however, adding anything to his remarks.

It is the purpose of this paper to give a more detailed description of the form, the individuals of which, being generally found as perfectly-preserved casts in iron-stone nodules, display the internal features in minute detail.

The great majority of the specimens examined are preserved in the collections of the British Museum (Natural History) and the Museum of Practical Geology. For facilities while working in the former, I am indebted to Dr. F. A. Bather, F.R.S., and especially to Miss H. M. Muir-Wood, who on

* J. Prestwich, "The Geology of Coalbrookdale," Trans. Geol. Soc. ser. 2, vol. v. p. 413 (1840).

† *Ibid.* p. 442.

‡ *Ibid.* pl. xxxix. fig. 21, and explanation.

§ W. W. Smyth, "Iron Ores of the Shropshire Coalfields," Mem. Geol. Surv. p. 242 (1862); E. Hull, "The Classification of the Carboniferous Series," Q. J. G. S. vol. xxxiii. p. 629 (1877).

many occasions has assisted me at the expense of considerable time and trouble. I should also like to thank Dr. F. L. Kitchin and Mr. J. Pringle for the great consideration I have received while visiting the Museum of Practical Geology.

Mr. Henry Woods, F.R.S., has very kindly read and criticised the manuscript.

Spirifer pennystonensis, sp. n.

Description of the holotype.—The holotype is a cast, and therefore nothing can be said of the external characters of the shell, except in so far as these have been impressed internally.

The shell is tumid, broader than long, with a hinge-line equal to the greatest width of the shell. The cardinal angles are approximately right angles. The cardinal area is moderately curved, very wide, and triangular in outline. The vertical lines or tubes seen on the area of many *Spirifers** are present and are relatively widely spaced; there are about fourteen on each side of the umbo. They terminate in a series of denticles which are well represented by pits on the cast. The dorsal valve possesses a short triangular area. The ventral umbo is considerably removed from that of the dorsal valve.

The mesial fold of the dorsal valve is slightly elevated above the flanks, and is distinctly delimited from them by two furrows somewhat wider than the rest.

Each flank is ornamented posteriorly with about eight to ten ribs, which increase dichotomously to seventeen to nineteen near the anterior border. They are fairly even, low, and rounded, and are separated by rounded furrows. The ribs on the ventral flanks are similar.

The mesial sinus of the ventral valve appears to have been relatively shallow near the umbo, but anteriorly it broadens and deepens. Unfortunately, the margin is completely destroyed in the holotype.

The internal features as exhibited on the cast are as follows:—

In the ventral valve the most outstanding features are the dental plates. These are represented by two very deep notches which diverge from the umbo and extend for a distance of nearly a half the length of the shell towards the

* J. Young, "On the Denticulated Structure of the Hinge-line of *Spirifer trigonalis*, Martin," Geol. Mag. n. s. vol. i. p. 18 (1884).

anterior border. At the umbo they are conjoined, and are extremely wide; each plate was about 3 mm. thick.

Between the dental plates, and anterior to them, lie the ventral muscle-impressions. These cover a more or less rhomboidal area of which the obtuse angles are rounded. This area extends for a distance equal to about the length of the shell, and is divided into two portions corresponding with the adductor and divaricator muscles respectively. The former are represented by an elongate narrow impression running along the middle of the scar, ornamented only by faint, obscure, longitudinal striations. They are sunk slightly deeper than the divaricators into the shell-substance anteriorly, but not so deep posteriorly. The divaricators cover a much wider area surrounding the adductors, from which they are clearly distinguished by their surface-markings. These consist of a series of dendritic corrugations distributed very roughly in a direction radial to an imaginary centre of the scar.

Bordering the divaricators may be seen faint traces of genital markings as a series of minute elongate pits.

In the dorsal valves the muscle-impressions are well seen. They consist of two pairs of adductors covering the greater portion of the mesial fold. Each pair is divided along the median line by a very thin, delicate, median septum, which disappears at a distance of about half the length of the shell. The posterior pair of impressions are quite smooth, and are bounded laterally by fine short septa. They merge into the anterior pair, which are distinguished by being corrugated and possessing dendritic terminations.

No indications of genital markings have been seen on this valve.

Vascular markings, which are well developed on other specimens of the species (*vide infra*), cannot be determined on the holotype.

Horizon and Locality.—The holotype is a specimen from the Pennystone Ironstone of "Coalbrookdale," now preserved in the Museum of Practical Geology, no. 44684. The species is very abundant at this horizon in the southern portion of the Coalbrookdale Coalfield, where it is associated with *Lingula mytiloides*, Sowerby, *Buxtonia* sp., a Rhynchonellid, and various Lamellibranchs.

Mr. J. T. Stobbs has correlated the Pennystone Ironstone with a marine band below the Gin Mine or Twist Coal of North Staffordshire*; it would thus lie towards the base

* J. T. Stobbs, "The Marine Beds in the Coal Measures of North Staffordshire," Q. J. G. S. vol. lxi. pp. 516 & 518 (1905).

of the zone *Anthracomya pulchra* of Mr. J. H. Davies and Dr. A. E. Trueman*.

The dimensions of the holotype are: length 39 mm., breadth 45 mm.

Other specimens from Coalbrookdale show the following characters:—

The shape of the shell is roughly semicircular, with the hinge-line longer than the length of the shell. The cardinal area is generally much narrower relatively than in the holotype, and is usually subparallel-sided. Not infrequently the area is differentiated into three regions by a pair of divergent lines extending from the apex to the hinge-line†. The vertical tubes (*vide supra*) cease at these lines, but the central portion bears fine vertical striations.

The dorsal mesial fold is well differentiated from the flanks, above which it is more or less considerably elevated. It is ornamented anteriorly with eight to ten low, rounded, fairly-regular ribs, which are produced apparently by the splitting of three ribs which occur near the umbo. They are separated by rounded furrows. The ribs on the flanks are generally similar to those of the holotype. Often, however, the anterior bifurcation of each rib causes those near the margin to appear in bundles of two.

The anterior margin is strongly uniplicate.

Internally the dental plates are generally less massive than those of the holotype (which is a remarkably large specimen). The muscle-impressions seem to be constant in shape, disposition, and surface-markings, and agree with the impressions of the holotype.

In some forms the vascular markings are preserved‡. In the ventral valve these consist of a reticulate network on the umbonal slopes surrounding the dental plates. They appear to have no definite arrangement, but branches are given off anteriorly which transgress the ribs. Slight indications of similar markings have been seen on the dorsal valve.

In the specimen figured by Sowerby§, and in certain others, the internal spiral appendages appear to be directed dorso-ventrally and to be confined to the postero-lateral portions of the visceral cavity. This is due to crushing.

* J. H. Davies and A. E. Trueman, "A Revision of the Non-Marine Lamellibranchs of the Coal Measures, and a Discussion of their Zonal Sequence," Q. J. G. S. vol. lxxxiii. pp. 246 & 248 (1927).

† Compare F. J. North, "On *Syringothyris*, Winchell, and certain Carboniferous Brachiopoda referred to *Spiriferina*, D'Orbigny," Q. J. G. S. vol. lxxvi. p. 170 (1920).

‡ "The Geology of Coalbrookdale," *op. cit.* pl. xxxix. fig. 21.

§ *Ibid.*

A polished specimen in the British Museum (B. 1129, from Madeley Court) shows that the spirals are situated normally and are directed laterally.

The species, although having an outward form not unlike that of *S. bisulcatus*, is distinguished from that and other Lower Carboniferous species by the characters of its dental plates, muscular impressions, and vascular markings.

EXPLANATION OF PLATE IV.

- Fig. 1.* *Spirifer pennystonensis*, sp. n.; holotype. *a*, view of ventral valve, showing dental plates and musculature; *b*, view of dorsal valve and cardinal area. Natural size.
- Fig. 2.* *S. pennystonensis*; paratype (No. 323 in the Sedgwick Museum, from Madeley). Outline-diagrams showing the shape of the shell. *a*, lateral view; *b*, anterior view. Natural size.
- Fig. 3.* *S. pennystonensis*; paratype, from Madeley. View of dorsal mesial fold, to show musculature of dorsal valve. *a*=adductor impressions; *m*=delicate median septum; *s*=short fine septa bounding posterior adductors. $\times 2$.
- Fig. 4.* *S. pennystonensis*. Diagram representing musculature of ventral valve. *a*=adductor impressions; *d*=divaricator impressions; *o*=ovarian markings. $\times 2$.
- Fig. 5.* *S. pennystonensis*; paratype, from Madeley, showing the development of the vascular system. *a*, ventral view; *b*, umbonal view. Natural size.

VII.—*The Carboniferous Coral Nemistium edmondsi*, gen. et sp. n. By STANLEY SMITH, M.A., D.Sc., F.G.S.

[Plate V.]

THE Carboniferous coral to which I here attach the name *Nemistium edmondsi* affords yet another instance of a well-characterised form arising from the genus *Lithostrotion*. Apparently it has been derived from *Lithostrotion irregulare* (Phillips) or *L. martini*, Edwards and Haime, through "*Diphyphyllum*." The coral was brought to my notice by Mr. Charles Edmonds, who sent me specimens that he had found in West Cumberland, and it has subsequently been recognized by Dr. T. A. Ryder among material collected by Mr. T. N. George in South Wales and by myself among *Lithostrotion* diphymorphs from the Avon Gorge. In all three instances the coral came from a high horizon in the Viséan. I have no doubt, now that the form has been described, that its distribution will be extended by other observers.

I wish to thank Mr. Edmonds for drawing my attention to this interesting coral, and for providing me with both material and stratigraphical data; Dr. Ryder and Mr. George for specimens from Kidwelly, and for supplying particulars concerning their occurrence; Dr. Bather for the loan of specimens in the British Museum, and Dr. Lang for his much valued criticism. To Dr. Ryder I am still further indebted for the excellent camera lucida drawings of *Nemistium edmondsi*, as produced on Pl. V.

Although primarily the object of this paper is to describe a coral which may prove of value to Carboniferous stratigraphy, I take the opportunity that it provides to revise certain views upon gemmation expressed in a previous paper * and to make some preliminary statements respecting the range of *Diphyphyllum* and *Lithostrotion*.

DIAGNOSES OF ALLIED GENERA.

Before considering the genus *Nemistium* and its genotype *N. edmondsi*, it is desirable to diagnose briefly its near allies *Lithostrotion*, *Diphyphyllum*, and *Aulina*, and, where necessary, to add a few remarks upon these genera.

LITHOSTROTION, John Fleming, 1828, 'A History of British Animals,' p. 508.

Diagnosis.—Phaceloid and cerioid Rugose corals with a styliform or flattened columella, with long major septa which typically, although not necessarily, reach the columella, with large tent-shaped tabulæ, usually supplemented at the theca by smaller and nearly horizontal tabulæ, and with dissepiments numerous in the large species but absent in the very small forms. Gemmation is non-parricidal. Text-figure (*Lithostrotion irregulare*).

Genotype.—*Lithostrotion striatum*, Fleming, *loc. cit.* = *Lithostrotion sive Basaltes minimus striatus et stellatus*, Edward Lhwyd, 1699, *Lithophylacii Britannici Ichnographia* . . . p. 124, pl. [xvi.]; 1760, *Editio altera*, p. 125, pl. xxiii.

DIPHYPHYLLUM, William Lonsdale, 1839, in R. I. Murchison and others, 'Geology of Russia, etc.,' vol. i. p. 622.

Diagnosis.—Phaceloid Rugose corals allied to *Lithostrotion*, but either with no columella or one so reduced that it is represented merely by impersistent spines arising from successive tabulæ, with short major septa, and with

* Ann. & Mag. Nat. Hist. ser. 9, vol. xvi. pp. 485-496.

flat, or distally arched, tabulæ. Gemmation is invariably parricidal.

Genotype.—*Diphyphyllum concinnum*, Lonsdale, *op. cit.* p. 624, pl. A, fig. 4. The holotype cannot be traced. Judging from Lonsdale's figure the form is identical with *D. lateseptatum*, M'Coy.

Remarks.—It would be consistent to frame a diagnosis of *Diphyphyllum* that would include the cerioid non-columellate forms of *Lithostrotion* as well as the phaceloid, namely, *Stylastræa conferta*, Lonsdale (*op. cit.* p. 621, pl. A, figs. 2, 2 a-c), and *S. basaltiformis*, M'Coy (Brit. Pal. Foss. p. 107), but for the present it is expedient to interpret the genus strictly upon its genotype. The species of *Diphyphyllum* grade into those of *Lithostrotion*.

Two types of tabular structure are found in *Diphyphyllum*; in the one, the inner tabulæ are almost horizontal and in-oscuate with the small outer tabulæ (text-fig., *Diphyphyllum* α), in the other, the inner tabulæ are strongly arched, and each arch rests upon the arch below, whilst the outer tabulæ abut against the inner series (text-fig., *Diphyphyllum* β). Provisionally I shall refer to those forms showing the first type of structure as "*Diphyphyllum* α ," and to those showing the second type as "*Diphyphyllum* β " (see text-fig. on p. 115). *Diphyphyllum* α is represented by *Diphyphyllum lateseptatum*, M'Coy, and *Diphyphyllum* β by *Diphyphyllum gracile*, M'Coy.

AULINA, S. Smith, 1916, Abs. Proc. Geol. Soc. No. 995, p. 2.

Compound Rugose corals allied to *Lithostrotion*, in which there is an inner tube, or aulos, separating the inner and larger tabulæ, which are flat, from the outer and smaller tabulæ, which incline peripherally (text-fig., *Aulina furcata*).

Genotype.—*A. rotiformis*, S. Smith, *loc. cit.*

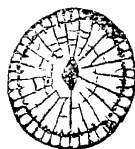
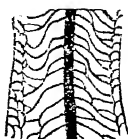
Remarks.—One phaceloid and one astræiform species only are known at present, no cerioid form having yet been found. This curtailed definition of genus is framed to meet present needs only. A fuller diagnosis is given in Ann. & Mag. Nat. Hist. 1925, ser. 9, vol. xvi. p. 486, but this requires some slight emendation as here shown (p. 117).

NEMISTIUM, gen. nov.

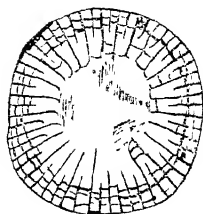
Etymology.—τὸ νῆμα, a thread; τὸ ἱστῖον, a web.

Diagnosis.—Compound Rugose corals agreeing with the species of *Diphyphyllum* β in growth-habit, manner of gemmation, and in most internal structures, but differing from these in having a loosely formed and irregular axial

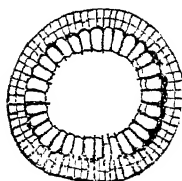
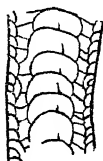
Lithostrotion irregulare.



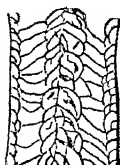
Diphyphyllum a.



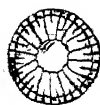
Diphyphyllum β.



Nemistium edmondsi.



Aulina furcata.



Lithostrotion, Diphyphyllum, etc. All figures approximately three times natural size.

structure, which in some instances persists through the corallites and in other instances arises from successive tabulæ and does not reach the tabula above.

Genotype.—*N. edmondsi*, sp. n.

Remarks.—*N. edmondsi* is very variable, and grades into *Diphyphyllum* in the same way that *Orionastræa ensifer* (Edwards & Haime), the genotype of *Orionastræa* (S. Smith, 1916, Abs. Proc. Geol. Soc. No. 995, p. 2), grades into *Lithostrotion*.

Nemistium edmondsi, sp. n.

External Characters.—In growth-habit and gemmation *N. edmondsi* is identical with the species of *Diphyphyllum*. The corallum is phaceloid, but the corallites, which are long and slender, are not crowded. Gemmation is parricidal and marginal; usually four gemmæ are reproduced simultaneously, but in some cases only two, and in others more than four. The corallites attain a diameter of 5 to 8 mm. The calices have not been seen, but to judge from the evidence of the coral structures one may infer a general resemblance to those of *Lithostrotion*, but a considerable variation even between calices of neighbouring corallites.

Internal Structures.—Neither the septa nor the dissepiments, nor in their main characters the tabulæ, differ from those of a *Diphyphyllum* β , but the appearance of the inner tabulæ is modified by the axial complex. In the smaller corallites there may be as few as 20 or 22 major septa, although there are usually more, and in the larger ones there are more than 30. The major septa extend inwards from the epitheca for about two-thirds the radius of the corallite, and the minor septa are two-thirds to three-fourths the length of the major septa. The dissepiments form a narrow peripheral zone of but one or two layers of irregularly large and small cells (see Pl. V. figs. 3 & 4). The inner tabulæ are strongly arched distally, and are superposed one upon another, forming a column against which both the outer tabulæ and usually the major septa abut, although the latter sometimes continue through the column wall. The outer tabulæ are small plates, which slope downwards towards the theca. The axial structure consists of a slender, somewhat irregular, medial plate, a few radiating lamellæ and some steeply inclined concentrically arranged tabellæ. The vertical elements may arise from the distal surface of a tabula and not reach the tabula above: or the axial complex may extend without interruption through the length of the corallite: or, again, here and there it may be entirely absent.

The structure is thus irregularly present and variable in appearance, both as seen at various levels in the vertical section of a single corallite and at the same level in the transverse sections of neighbouring corallites (Pl. V. figs. 1-4).

Holotype.—British Museum Specimen R 25488 (R 25499, section cut from the same); *Diphyphyllum* Zone (D 2), Lower Carboniferous, Eskett Quarry, near Frizington, West Cumberland. The corallites in the type are 5 to 6 mm. in diameter, and have 20 to 22 major seta.

Ontogeny.—Gemmation and the development of the hystero-corallites are precisely similar in *N. edmondsi* and the allied species *Aulina furcata*, described and illustrated by me in 1925 (Ann. & Mag. Nat. Hist. ser. 9, vol. xvi. pp. 493-4, pl. xxiv. figs. 4a, 5, & 6). As in *A. furcata* the buds, if there are more than two, enclose according to their number a triangular, quadrate, or polygonal space (Pl. V. fig. 2).

It is convenient at this place to criticise a statement I made in the above-quoted paper concerning reproduction in *Aulina furcata* (p. 493). I referred to this as "undoubtedly of a fissiparous nature," and in a footnote I cast doubt upon the view that I had previously expressed (1915, Q. J. G. S. vol. lxxi. p. 233) that reproduction in Rugose corals was entirely gemmiparous. Further investigation of the subject, involving the examination of a large number of Silurian, as well as Carboniferous corals, convinces me that I was right in the first instance, and that I was led to wrong conclusions in the case of *A. furcata*. I therefore contradict the statement that gemmation in *A. furcata* and in other species there mentioned was fissiparous and retract the emendation to my original view. This involves a slight revision of my former diagnosis of the genus *Aulina*.

Distribution.—

West Cumberland: The holotype and paratypes were obtained at Eskett Quarry near Winder Station, and two miles north-east of Frizington, from the *Orionastræa* Band at the top of the "Pot Hole Bed" in the "Fourth Limestone"*. The horizon has been assigned by Mr. Edmonds to the *Dibunophyllum* Zone and to the *Lonsdaleia floriformis* Subzone D 2†. The coral occurred in position of growth in the *Orionastræa* Band, and as crushed and broken fragments in the thin mudstone above. Five large bushy colonies,

* C. Edmonds, 1925, Geol. Mag. vol. lxi. p. 81.

† *Ibid.* p. 127.

twelve to eighteen inches in height, and two feet wide towards the top, were observed in the quarry face within a length of twenty yards. The corals associated with *N. edmondsi* included *Lithostrotion junceum*, *L. irregulare*, both very common; *L. portlocki*, abundant; *Orionastræa ensifer* and *O. phillipsi*, common; *Corwenia rugosa* and *Aulophyllum*. *Diphyphyllum* was not found in the band, but was very abundant at the base of the Saccamina Limestone above*.

The coral was found at the same horizon, and associated with the same forms, at Clints Quarry, near Egremont; Yeathouse Quarry, near Yeathouse Station; Rowrah Head and Rowrah Hall Quarries, near Rowrah Station; Kelton Head Quarry, one mile N.E. of Rowrah Station; Salter Hall Quarry, half a mile E. of Eskett Quarry, and also at the same horizon, but with a somewhat different association, at Ward Hall East Quarry, south of Aspatria, about fifteen miles N. of Eskett †.

South Wales: Brynhyfryd Quarry on Mynydd-y-Gareg, between two and three miles N.E. of Kidwelly, Horizon D 2. The specimens collected at Brynhyfryd by Mr. George are larger than the typical forms from Cumberland, have a thicker medial plate, and much secondary tissue has been developed both at the axis and at the periphery. Nevertheless, some corallites have no axis, and thus remain in the *Diphyphyllum* state. The largest corallites reach a diameter of 9 mm. and have over thirty major septa. The corals associated with these included *Lithostrotion* near *martini*, *Orionastræa ensifer*, *Palæosmilæa*, Clisiophyllids, and a *Caninia*. Sections in British Museum R 25862-4.

* The detailed section of the horizon supplied to me by Mr. Edmonds is as follows:—

	ft. in.	ft. in.
Saccamina Limestone		18 0
(Corals including <i>Diphyphyllum</i> abundant.)		
Shaly mudstone	0 0 to 1 0	
(With crushed and rolled corals, including a distinctive <i>Dibunophyllum</i> .)		
Siliceous sandstone yielding plant-remains....		2 9
Green mudstone	0 0 to 1 0	
(Contains crushed corals, including <i>N. edmondsi</i> .)		
Orionastræa Band		6 0
(All these beds occur within the higher part of the Fourth Limestone.)		

† The specimen I received from Ward Hall East Quarry was both larger and better preserved than any of those from Eskett and neighbourhood. The corals found with it included *Lithostrotion irregulare*, very abundant, *L. near portlocki* (large form), *Lonsdaleia floriformis* (small form) which are fairly abundant; a large *Caninia* and a large *Palæosmilæa*.

Bristol: Round Point, Avon Gorge, Horizon D 2. The colonies of *Diphyphyllum* β , which are very prolific here, may contain corallites which show characters of *Nemistium* in rudimentary manner and others in which these characters are strongly developed. The material thus provides us with the passage-forms between *Diphyphyllum* and *Nemistium*. Other coral species common at Round Point are *Lithostrotion irregulare*, *L. portlocki*, *Orionastræa ensifer*, *Lonsdaleia floriformis crassiconus*, *Palæosmilia regium*, and *Dibunophyllum* ψ . It is interesting to note the association of *Nemistium* and its passage-forms with *Orionastræa ensifer*, which is itself a passage-form between *Lithostrotion portlocki* and the more strongly thamnastroid species of *Orionastræa*.

Section in British Museum R 17008.

CONCLUDING REMARKS.

Whilst I have provisionally placed *Nemistium edmondsi* in a separate genus, I have borne in mind its close relationship to *Lithostrotion*. When the group is revised it may be found practicable to merge *Nemistium* and *Diphyphyllum* in *Lithostrotion*. Even should this be done, it would still be convenient to have available a name for distinguishing the particular combination of structures such as are exhibited by *Nemistium*.

It is clear that *Nemistium edmondsi* is a further development of *Diphyphyllum* β (see pp. 114, 115), as, no doubt, is also *Aulina furcata*, but in a different direction. *Nemistium* has added to the structure of *Diphyphyllum* β a variable and impermanent axial complex, while *Aulina furcata* has replaced the column of superposed arched tabulæ by a complete tube traversed by horizontal tabulæ. Although it would seem that the formation of this tube had been taken over by the septa, nevertheless the "aulos" probably had its beginning in the purely tabular column of *Diphyphyllum* β .

In conclusion, I wish to draw attention to the fact that while *Nemistium* and *Aulina* clearly represent end branches of the *Lithostrotion* lineage, yet the exact relationship of *Diphyphyllum* to *Lithostrotion* is by no means certain, and further field-evidence is required before the matter can be fruitfully discussed. The facts concerning the distribution of the two genera as I know them* are as follow: *Diphyphyllum* α and large forms of both phaceloid and cerioid *Lithostrotion* have been found in the *Syringothyris*-zone (C);

* In view of revising the species of *Lithostrotion* and its allied genera, I shall be grateful to field-workers for data which will add to a more precise knowledge of their range.

these become common in the succeeding subdivision of the Lower Carboniferous (S 1) and range up into the *Dibunophyllum*-zone (D), in which the smaller "species" of *Lithostrotion* are abundant. *Diphyphyllum* β is only known to me from the higher part of the zone (D 2 and D 3); *Nemistium edmondsi* has only been found in D 2 and *Aulina furcata* in D 3.

EXPLANATION OF PLATE V.

Nemistium edmondsi, sp. n., Upper Visean (D 2), West Cumberland.
Camera lucida drawings.

- Fig. 1. Transverse section of a number of corallites showing the variation exhibited by neighbouring members of a corallum. Ward Hall East Quarry, near Aspatria. Slide of British Museum specimen R 25840. $\times 2$.
- Fig. 2. Transverse section through a "nest" of five corallites at the hystero-brephic stage. Same slide as fig. 1. $\times 2.75$.
- Figs. 3 & 4. Longitudinal sections. Eskett Quarry, near Winder Railway Station. (Type-locality.) Sections R 25839 and R 25838 British Museum. $\times 2.5$.

VIII.—A new Genus and Species of Glossophagine Bat, with a Subdivision of the Genus *Chceronycteris*. By OLDFIELD THOMAS.

AMONG a number of small mammals kindly sent to me for examination by the authorities of the Museo Civico, Genoa, there occurs a bat belonging to the Glossophaginæ, and allied to *Lonchophylla mordax*, but sufficiently distinct to deserve not only specific but generic distinction.

PLATALINA, gen. nov.

General characters, including number and positions of teeth and development of interfemoral membrane, as in *Lonchophylla*, but the facial portion of the skull greatly hypertrophied, just as it is in *Chceronycteris mexicana*, the skull of the new species exceeding in length that of any other member of the subfamily. Teeth in general as in *Lonchophylla*, but the inner upper incisors are even more broad and spatulate, and so precumbent as to be almost horizontal; outer upper incisors quite small and slender. Lower incisors well developed, broad, touching one another, the series

forming a continuous line from canine to canine. Premolars and molars very long, horizontally, and narrow, the upper molars in particular much narrower than those of *Lonchophylla*. Lower premolars long, narrow, their anterior and posterior secondary cusps proportionally much more developed than in *Lonchophylla*. Interfemoral membrane well developed, nearly a centimetre in breadth, with the minute tail appearing on the upper surface of its base.

Genotype :—

Platalina genovensium, sp. n.

Size nearly the largest of the subfamily and much greater than in *Lonchophylla*. Fur of average length, hairs of back about 8 mm. long. General colour pale brown, the hairs whitish for the greater part of their length, with pale brown tips; this brown would probably have been darker before the specimen was put into spirit and later skinned out. Under surface little lighter than upper.

Skull large, with long parallel-sided muzzle and well-filled brain-case. Zygomata absent. Teeth as above described.

Dimensions of the type (the italicized measurements taken in Genoa on the spirit-specimen before skinning):—

Forearm 46 mm.

Head and body 72 mm.; *tail* 9; *ear* 13; third finger, metacarpal 45, first phalanx 17·5; lower leg and hind foot (c. u.) 30; calcar (c.) 9.

Skull: greatest length 32; condylo-basal length 31; breadth of brain-case 11; muzzle from line between olfactory and cerebral fossæ of brain-case 17·6; brain-case from the same line to the occiput 15·2; breadth of muzzle opposite m^1 5·2; interorbital breadth 5; front of canine to back of m^3 11.

Hab. Peru. Type from the neighbourhood of Lima.

Type. Adult male, skinned from spirit. B.M. no. 27. 11. 19. 38: Collected 23rd April, 1909, by Signor Nicolo Esposito; received in exchange from the Genoa Museum.

The species-name is a tribute to the many Genoese who have helped in increasing our knowledge of the Chiroptera, and with whom I have had such pleasant relations these many years. The collector, Sr. Esposito, the Director at Genoa, Dr. R. Gestro, Dr. O. de Beaux, and, above all, my old friend the Marchese G. Doria, most charming of men, have all helped in the matter, and the name is now given as a remembrance of them.

This striking bat is at once distinguishable from the other long-headed member of the family, *Chaeronycteris mexicana*, by the characters of the upper incisors, which are as in *Lonchophylla*, close together in the middle line, the inner far larger than the outer pair. In essential characters it is no doubt nearly allied to *Lonchophylla*, but may be distinguished by the very great disproportion of the facial part of the skull to the cranial, the length of the face, measured as described above, exceeding that of the brain-case, while in *Lonchophylla*, as in other normal bats, the converse is the case. The much greater proportional development of the supplementary cusps of the lower premolars is also an important character.

But if the cranial disproportion in this bat justifies its generic distinction from *Lonchophylla*, the same may be said of the similar disproportion in *Chaeronycteris mexicana* as compared with the other described species of that genus, and I would therefore now subdivide the latter. *Chaeronycteris* was founded by Tschudi in the 'Fauna Peruana' on two species—*peruana* and *mexicana*,—but with no indication as to which should be taken as the genotype. In his earlier 'Prospectus,' however, he speaks only of *peruana* in conjunction with the generic name, though both are "nomina nuda," and it would have been more suitable if this species, and not *mexicana*, had been taken as genotype. But Peters, in 1865 and 1868, and Dobson, in 1878, treated *mexicana* as the chief or only species of *Chaeronycteris*, and Miller, in 1907, definitely chose it as genotype—a choice which must be accepted. Moreover, it follows the broad principle that "nomina nuda" should be treated as if they had never been published.

Accepting, then, *mexicana* as the genotype of *Chaeronycteris*, and putting *peruana* into the synonymy of *Anoura geoffroyi*, we may form a new genus, to be called *Chaeroniscus*, for the normal-headed species *minor*, *intermedia*, *inca*, and *godmani*, the first-named being taken as genotype.

These species are distinguishable from *Chaeronycteris*, as represented by *mexicana*, both by the ordinary normal shape of the skull, in which the muzzle is shorter than the brain-case, and by their lower premolars having three more or less subequal cusps, while in *Chaeronycteris* the middle cusp is much higher than the anterior and posterior. Curiously enough, the relative development of these cusps is the exact converse of what we find in the parallel case of *Platalina* and *Lonchophylla*, the subequal cusps occurring in the long-headed form in the latter case.

The conclusions now arrived at may be conveniently put in a synoptical form as follows:—

- A. Upper incisors separated in pairs on either side. No lower incisors.
- a. Upper premolars 3. Interfemoral membrane almost obsolete.
 - 1. *Anoura*, Gray. Syn. *Rhynchonycteris*, Tschudi (nom. nud.).
Genotype. *A. geoffroyi*, Gray.
 - b. Upper premolars 2. Interfemoral membrane well developed.
 - a'. Muzzle of skull greatly lengthened. Lower premolars with middle cusp longest.
 - 2. *Chæronycteris*, Tschudi.
Genotype. *C. mexicana*, Tsch.
 - b'. Muzzle of skull of normal proportions. Cusps of lower premolars subequal.
 - 3. *Chæroniscus*, gen. nov.
Genotype. *Chæroniscus minor* (*Chæronycteris minor*, Peters).
- B. Upper incisors together in the centre; the inner pair much the larger. Lower incisors present. Interfemoral broad.
- a. Muzzle of skull lengthened. Supplementary cusps of lower premolars well developed. Lower incisors large.
 - 4. *Platalina*, gen. nov.
Genotype. *P. genovensium*, sp. n.
 - b. Muzzle of skull of normal length. Supplementary cusps of lower premolars very small. Lower incisors small.
 - 5. *Lonchophylla*, Thos.
Genotype. *L. mordax*, Thos.
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IX.—*Species of the Coleopterous Genus Rhyncogonus, Sh.*
(Curculionidæ), from the Marquesas Islands. By R. C. L.
PERKINS, D.Sc., F.R.S.

THE five species of *Rhyncogonus* here enumerated are from the material collected in the Marquesas by the 'St. George' Expedition, and, having for a long time been specially interested in this genus, I was much pleased to receive them for examination and description. Four of the species are new, and all of them possess characters in common, such as are not found in any of the known species of the Hawaiian group, where the genus is richly represented. Whether each series will continue thus distinct when the species have been completely collected is, of course, uncertain, as, no doubt, others remain to be discovered in each of these groups, and also in other islands or island groups intermediate forms may occur.

(1) *Rhyncogonus duplex*, sp. n.

Niger, oculis parum fortiter convexis, rostro post antennis late conspicueque excavato, antennarum funiculi articulis omnibus elongatis, primo secundoque subæqualibus, hoc quam tertius et quartus. una conjuncti, plus minusve brevior. Mas sat gracilis, pilis albidis depressis aliisque gracillimis et erectis undique vestitus; femina vestitu setarum subsquamiformium appresso valde differt. Long. (cum rostro) 14–17 mm.

This species is remarkable for the comparatively slight convexity of the eyes, in which character it approaches *R. koebelei* of the Hawaiian Islands, while in other respects there is no resemblance between them. The legs vary in colour from practically black to a more or less distinct red.

Head of ♀ with scaly appressed hairs, yellowish and densest in the rostral canal, around the eye-margins, on the sides of the rostrum along the antennal grooves, and on the head beneath. In the ♂ the decumbent hairs are white and not scale-like, while slender erect ones take part in the clothing generally. Pronotum fairly well covered with yellow squamiform clothing in the ♀, more thickly so towards and on the sides than in the middle, where, no doubt, abrasion is easy; in the ♂ well clothed with decumbent white and very slender erect hairs. The puncturation is usually dense and rugose, of mixed coarser and fine punctures, sometimes more distinct (less rugose) in the ♀. Scutellum densely clothed, so as to form a distinct pale spot. Elytra in fresh examples with a fairly even distribution of the clothing, at most with a perceptible tendency to form flecks or lines. Their sculpture consists of many rows (sometimes confused) of not very coarse punctures, which are so impressed as to appear often rather as granulations or elevations of the surface; between these there is a fine subobsolete puncturation, whence spring the decumbent hairs. The slender erect hairs in the ♂ are as conspicuous as on the pronotum, but the elytra of the ♀, except for the usual setæ, which are chiefly noticeable along the sides posteriorly, are without erect hairs. The surface is generally more or less shining, but can be quite opaque.

In the ♂ the ventral abdominal segments are copiously and very coarsely granulated or tuberculate, the tubercles for the most part well separated, the spaces between them being almost smooth, though at the base of the abdomen the surface is also rugose. The tubercles are continued on to the apical segment, the clothing of which is not dense, so that the surface is easily seen.

In the ♀ the abdominal sculpture is very different; the basal segments are much wrinkled and also have a very dense minute sculpture of the surface, and, on the second and third at least, some small tubercles can be seen quite distinctly, but there is no approach to a development of these such as is observed in the ♂; the apical segment is shining, thinly pubescent, and with feeble punctures. The clothing consists of decumbent hairs nearly evenly distributed on most of each segment, but becoming denser at the sides; the sides of the metasternum and meso- and meta-pleura have a dense clothing of appressed, yellow, thickened or subsquamous hairs. In this sex (♀) the femora have similar appressed hair, erect setæ being chiefly noticeable along the under side, but in the ♂ long, slender, erect hairs are generally distributed, as also on the tibiæ, where they are much longer than those of the ♀.

Hub. Marquesas, Fatu Hiva; seven specimens "on pepper sp., 1500-2500 ft., Jan. 1925" (C. L. Collenette).

(2) *Rhyncogonus mimus*, sp. n.

R. duplicis forma et facie; ♂ sat gracilis, tenuiter et subæqualiter albido-pubescent, segmentis abdominis ventralibus fortiter et conspicue granulatis; ♀ setis decumbentibus haud tenuibus flavescens, sed uterque sexus oculis prominentibus et convexis facile distinguendus; ♂ pilis gracillimis erectis haud vestitur. Long. 11-14 mm.

Except that the male clothing lacks the long, slender, erect hairs, and that both sexes have the eyes normally convex and prominent and the rostrum less deeply channelled, this species closely resembles *R. duplex* in form and sculpture and in its sexual dimorphism. It is evidently a smaller insect.

Rostrum behind the antennal insertion only subdepressed above, not deeply and widely channelled; the sculpture towards and between the eyes is coarsely rugose. The second funicle-joint of the antennæ appears generally subequal to the third and fourth, but in some specimens actual measurement shows that it is distinctly shorter. The decumbent hairs of the pronotum and elytra in the ♂ are shorter and much less conspicuous than those of *duplex*, but in the ♀ the yellow clothing is as dense as in that species or still denser. Pronotum rugosely punctate, sparsely clothed with short, pale, decumbent hairs in the ♂, much more densely with thicker yellow ones in the fresh ♀. Elytra copiously and fairly evenly clothed with hairs, as on

the pronotum, in the ♀, inconspicuously with whitish ones in the ♂. In the latter the rows of punctures on the elytra are generally quite evident, but in the ♀ the sculpture is apparently rougher as a rule and the punctures, as such, are difficult to distinguish, sometimes appearing as granulations or as tubercles.

The sculpture of the ventral segments is much like that in *R. duplex*, the basal segments of the ♀ with a dense and shallow rough sculpture, the apical segment shining with fine indefinite or shallow punctures, and on each side basally a more or less rounded and usually deep fovea. In fresh examples of this sex the sides of the ventral abdominal segments and of the meso- and metasterna as well as the pleura are very densely clothed with appressed yellow hairs, as also are the femora. In the ♂ the ventral segments bear copious distinct tubercles, which extend more or less on to the apical segment, this being thinly clothed, and, as usual, broad or truncate at the apex.

Hab. Marquesas, Hiva Oa; eight specimens "on pepper and other plants, 2500-3000 ft., Dec. 1924" (*C. L. Collette*).

(3) *Rhyncogonus eximius*, sp. n.

Niger, setis ferrugineis decumbentibus, aliisque gracillimis, erectis et pallidioribus passim vestitus, oculis prominentibus, sat convexis. Antennarum funiculi articuli 4-7 parum fortiter elongati, haud quaquam bis longiores quam latiores, articulus secundus duobus sequentibus subæqualis. Elytra confuse punctata, lateribus postice lineis fere rectis convergentibus, parum sinuatis. Long., ♀, 15 mm.

So far as I can judge without dissecting the specimen, the single example of this remarkable species is a ♀, but the general character of its clothing is more like that of the ♂ of *R. duplex*, and entirely unlike that of the ♀, since the head, thorax, elytra, and legs all have a clothing of long, slender, erect hairs in addition to the decumbent ones.

Black, the depressed hairs ferruginous or reddish orange, not squamiform, the erect ones paler, yellowish, slender, and often sinuate. Head thinly clothed; beak above shining, somewhat concave, but not conspicuously channelled, irregularly punctured. Eyes prominent and convex. Antennæ with the joints of the funicle after the first two not at all strongly elongated, the scape with erect and depressed hairs conspicuous. Pronotum at the sides with very dense orange-red appressed hair almost concealing the surface; on the

disc nearly bare, possibly more or less abraded, and coarsely punctured with considerable smooth spaces between some of the punctures; a narrow, smooth, median line extends back from near the front margin, but disappears on the disc, while traces of it are again visible amongst the closer and finer sculpture of the posterior part. Scutellum densely clothed, appearing as a pale dot to the naked eye. Elytra with copious ferruginous appressed clothing; in the specimen described, along the suture and on a longitudinal area towards the sides of each wing-case, the setæ are less dense; the pseudopleura also have a more or less general clothing or at least no definite maculations. The pale erect hairs are thinly distributed over the whole elytra. Their sculpture is very rough and indefinite, and the outline is unusual, the sides appearing nearly straightly convergent on the posterior half and without any distinct sinuation towards the apex. The meso- and metasterna are densely clothed compared with the abdomen, the sides of the metasternum and the pleura are still more densely covered. Abdomen beneath shining, for the most part not densely punctured, the punctures ill-defined or granulate, as is particularly noticeable on the anteapical segments; the apical one finely and shallowly punctured, with thin erect hairs (like those of *duplex*) and a deep roundish fovea on each side towards the base. Femora at least for a large part densely clothed with appressed setæ, and thinly (but conspicuously) with slender erect hairs, the latter being more dense on the tibiae. The hind femora outwardly, where they are nearly bare, show a slight metallic tint, and in some aspects a very faint æneous tinge may be seen on the elytra. The robust cuneate elytra, which lack the usual distinct sinuation of the outline and the appearance of being produced apically, give this insect a peculiar facies.

Hab. Marquesas, Fatu Hiva, 1500–2000 ft.; “on pepper sp., Jan. 1925” (*C. L. Collenette*). A single ♀, the antenna on one side imperfect.

(4) *Rhyncogonus lugens*, sp. n.

Niger, forma elongata et (præcipue maris) gracili, pedibus antennisque sæpe rufescentibus, harum articulis fortiter elongatis, oculis prominentibus, parcissime vestitus, pronoto ad angulos posteriores utrinque plaga parva pallide squamosa, scutello dense conspiciueque vestito.

Long. 8–11 mm.

Head very sparsely clothed, but with an evident condensation of squamose hairs about the eye-margin; sculpture

of front and rostrum rugoso-punctate, forming longitudinal strigæ. Antennæ very slender, all the joints elongated, the third joint of the funicle usually three times as long as wide, or more, varying a little.

Pronotum sparsely and inconspicuously clothed, coarsely rugose-punctate all over, with a smooth median line sometimes distinct, sometimes more or less effaced, or even wanting; a dense patch of pale scales is always conspicuous at the hind angles, and the scutellum is so densely clothed as to form a pale dot to the naked eye.

The elytra are very sparsely clothed with very minute hairs, but in the ♀, at least on the posterior parts, indefinite patches or areas of squamosity are present. In the ♂ these appear to be much less developed or altogether wanting in some specimens. The sculpture, as usual, varies somewhat, sometimes appearing as a close rough granulation or tuberculation, but sometimes the rows of punctures remain more or less distinct. The pseudopipleura are very sharply separated, unusually large in proportion to the dorsal-facing surface, and are clothed with sparse inconspicuous hairs in the ♀, sometimes with a few scales on the apical part. At the sides of the metasternum apically there is a dense spot of pale clothing and one or two others on the sides of the thorax anterior to this, the intermediate abdominal ventral segments having also a dense patch on each side. The sculpture of the ventral segments in the ♂ consists of distinct, separate granulations or fine tubercles, which sometimes extend on to the last segment, though sometimes this has hardly more than an indefinite sparse puncturation. In the ♀ on the basal segments there is a very dense microscopic surface sculpture, amongst which are remote and more or less obsolete granulations. The femora have the decumbent clothing fairly regular in distribution, but not at all dense, and the surface is easily seen.

This species is distinguished at a glance by the conspicuous, though often small, patch of pale clothing at the hind angles of the pronotum, which in dorsal aspect appears otherwise unclothed to the naked eye.

Hab. Marquesas, Hiva Oa, 2500–3000 ft., Dec. 1924. Seventeen examples (one much mutilated) “on pepper and other plants” (*C. L. Collette*).

(5) *Rhyncogonus walkeri*, Perkins.

Rhyncogonus walkeri, Perkins, Ent. Mo. Mag. xxxv. 1899, p. 56.

This species in its facies resembles many of the Hawaiian

forms, but it cannot be said to be nearly allied to any one of these. Though it differs greatly from the other species collected in the Marquesas, it is really, I think, more nearly related to them than to the Hawaiian.

The first funicle-joint of the antennæ is distinctly shorter than the second. In the ♀ the whole sides of the pronotum are densely covered with thick or scale-like appressed hairs, but in the ♂ the clothing is more patchy or irregular. In all the specimens now examined the pseudepipleura have the dense clothing of a deeper colouring, often red or orange, than that of the dorsal surface. The femora are more or less evidently banded before the apex by a denser clothing. The copious tubercles of the ♂ ventral segments are very distinct and are continued on to the apical segment, which is not hairy enough to conceal the sculpture. As in the other species the sculpture of the ♀ is quite different. The length varies from 8.5–12 mm.

Hab. Marquesas, Nuka Hiva, 2500–3000 ft., Jan. 1925; 10 specimens "beaten from ferns, etc." (*C. L. Collenette*). There are a dozen examples of this species in the British Museum collected by Commdr. J. J. Walker on the same island many years ago.

X.—*New Hymenoptera of the Family Bethyliidæ.*

By ROWLAND E. TURNER, F.Z.S., F.E.S.

Family Bethyliidæ.

Epyris subalatus, sp. n.

♀. Nigra; mandibulis, antennis, tegulis, tibiis tarsisque fulvofuscis; femoribus fuscis; alis brevissimis.

Long. 4 mm.

♀. Mandibles blunt, with one acute tooth on the lower angle at the apex, and with a very small acute tooth near the middle of the inner margin. Head subopaque, evenly and rather sparsely punctured, subquadrate, a little longer than broad; posterior ocelli situated close to the hind margin of the head. Eyes large, without hairs, separated from the hind margin of the head by a distance equal to about three-quarters of their length. Scape thick, as long as the three basal joints of the flagellum combined, the second joint broader than long. Pronotum longer by one-quarter than its

greatest breadth, much narrowed anteriorly and rounded, a little more finely punctured than the head. Mesonotum very short, only half as long as the scutellum, parapsidal furrows very distinct. Scutellum with the two basal foveæ far apart. Median segment strongly margined posteriorly and laterally, smooth and shining, with a strong median carina and a weaker oblique carina on each side of it; at the base these carinæ are nearer to the median carina than to the side of the segment, at the apex they become less distinct and converge, the space enclosed by the carinæ is rather strongly reticulate. Abdomen smooth and shining. The sides of the median segment are finely aciculate. Fore femora very stout; intermediate tibiæ with very minute spines, tarsal ungues simple, not toothed. Wings rudimentary, only reaching to the apex of the median segment.

Hab. Mossel Bay, South Africa, July and December (Turner).

Described from four specimens.

Epyris plurilineata, sp. n.

♀. Nigra; mandibulis, antennis, pedibus, segmentisque abdominalibus quinto sextoque rufis; alis hyalinis, venis fuscis. Long. 7-9 mm.

♀. Head subquadrate, evenly and rather strongly punctured, an impressed line reaching from between the antennæ halfway to the anterior ocellus; posterior ocelli nearer to the hind margin of the head than to each other. Mandibles moderately broadened at the apex, ending in two strong and rather blunt teeth, of which the lower is the longer; above the upper tooth the mandible is bent inwards and armed with three very short teeth set close together just behind the upper tooth. The two basal joints of the flagellum are as broad as long; the scape more than twice as long as broad, shining, with a few small punctures; the head and thorax sparsely clothed with long hairs. Pronotum a little longer than its greatest breadth, narrowed and rounded anteriorly, deeply but not closely punctured, with a smooth space along the middle. Mesonotum and scutellum very sparsely punctured, parapsidal furrows slightly convergent posteriorly, the foveæ of the scutellum far apart. Median segment finely transversely striated, with seven longitudinal carinæ, the outer on each side only feebly developed and almost converging with the next at the apex, the striæ between the carinæ coarser and not as close as those on the sides; the surface of the posterior truncation delicately transversely striated, with a median

carina. Abdomen shining, the two basal segments smooth, the apical segments shallowly punctured. Intermediate tibiæ with spines; fore tarsi normal; tarsal ungues with one very small tooth near the middle.

Hab. Thabasilitche, S. Rhodesia, July 6, 1924; Bulawayo, S. Rhodesia, August 25, 1923 (*R. H. R. Stevenson*); Mossel Bay, Cape Province, April to November (*R. E. Turner*).

Male specimens measure only 4 mm. and have the antennæ half as long as the whole insect, the second joint of the flagellum twice as long as the first and much longer than broad. The species was not at all plentiful at Mossel Bay, where the specimens were usually smaller than those described above from Rhodesia, females measuring 5-7 mm. I took two males at Mossel Bay in April 1921 and one at Aliwal North in December 1922. Two females taken at Stigi, Tanganyika Territory, October 1917, belong to this species.

Epyris levissimus, sp. n.

♀. Nigra; mandibulis, antennis, tibiis tarsisque fusco-ferrugineis; alis hyalinis, stigmatibusque fuscis; segmento mediano tricarinato, pronoto nitido, impunctato.

Long. 4-5 mm.

♀. Mandibles rather broad at the apex, the lower angle produced into a short acute tooth, otherwise without teeth. Head a little longer than broad, shining and almost smooth, with a few very small punctures on the front and a frontal longitudinal groove; malar space very short; eyes separated from the hind margin of the head by a distance exceeding half their own length; posterior ocelli situated close to the hind margin of the head. Scape stout, sparsely punctured, with a few long hairs, as long as the three basal joints of the flagellum combined. Pronotum smooth and shining, as long as its greatest breadth, narrowed and rounded anteriorly; mesonotum and scutellum smooth and shining; parapsidal furrows not very deep, the median abscissa of the mesonotum behind, a little narrower than the lateral; foveæ of the scutellum far apart. Median segment margined laterally and posteriorly, smooth and shining, with three longitudinal carinæ, the lateral carinæ convergent, twice as far apart at the base as at the apex, the space between the carinæ finely rugulose and opaque. Abdomen smooth and shining, as are also the pleuræ; sides of the median segment coriaceous. Intermediate tibiæ spinose; anterior femora compressed and somewhat concave on the inner side; basal joint of fore tarsus with two apical spines and two smaller

spines on the outer margin; tarsal unguis without teeth. A row of hairs along the costal margin of the fore wing reaching to the stigma; radial nervure more than twice as long as the basal.

Hab. Cape Province; Ceres, February and March; Milnerton, February (*Turner*).

Allied to *E. muiri*, Turn. & Waterst., from Natal, differing in the longer head and the almost complete absence of punctures on the head and thorax.

Epyris hottentottus, sp. n.

♀. Nigra, nitida; mandibulis, antennis, tegulis, tibiis tarsisque ferrugineis; alis pallide fusco-hyalinis, venis ferrugineis; segmento mediano unicarinato; tibiis intermediis spinis brevibus instructis.

Long. 4 mm.

♀. Eyes separated from the hind margin of the head by a distance equal to three-quarters of their length; posterior ocelli situated close to the hind margin of the head. Scape very finely punctured, with short fulvous hairs near the apex, a little longer than the three basal joints of the flagellum combined. Mandibles bidentate, the outer tooth the longest. Head subquadrate, shining, finely and rather sparsely punctured, with a short frontal groove from between the antennæ. Thorax shining and almost smooth; the pronotum twice as long as the mesonotum, sparsely and very finely punctured; parapsidal furrows widened posteriorly, but separated from each other by much more than their own breadth; foveæ of the scutellum far apart. Median segment coriaceous; with one longitudinal carina, on either side of which is a rather strongly reticulate space, which is gradually narrowed to the apex; the face of the posterior truncation with a longitudinal groove; the sides of the segment shining, very delicately striate-aciculate. Abdomen smooth and shining. Fore tarsi normal, joints 2-4 not broadened; intermediate tibiæ with short spines; tarsal unguis simple. Radius nearly four times as long as the basal nervure, the latter joining the subcosta at the base of the hyaline spot at the base of the stigma.

Hab. Mossel Bay, Cape Province; June 1921 (*Turner*).

Epyris microphthalmus, sp. n.

♀. Nigra, nitida; mandibulis, antennis, tegulis pedibusque fulvo-ferrugineis; alis hyalinis, levissime flavo-dilutis, venis ferrugineis; mandibulis acutis, haud dentatis; tibiis intermediis spinosis; unguiculis simplicibus.

Long. 4 mm.

♀. Head subquadrate, sparsely, but distinctly, punctured; eyes small, separated from the hind margin of the head by a distance half as great again as their own length; ocelli very small; the posterior pair situated close to the hind margin of the head. Scape slightly longer than the three basal joints of the flagellum combined, finely punctured; flagellum stout, the second joint broader than long, also the fourth, fifth, and sixth joints; first and third joints scarcely longer than broad. The front is slightly produced, forming a bilobed prominence above the base of the antennæ. Thorax sparsely punctured, pleuræ almost smooth; pronotum at least twice as long as the mesonotum; parapsidal furrows narrow and almost parallel; foveæ of the scutellum rather small, far apart, and connected by a shallow groove. Median segment shining and smooth with a low median carina, on either side of which at the base is a very low carina, these carinæ moderately convergent, but do not extend beyond halfway to the apical margin, the space between the carinæ and continued to the apex is opaque and coriaceous. Abdomen rather broad and flattened, smooth. Fore femora much thickened. Radial nervure four times as long as the basal.

Hab. Mossel Bay, Cape Province, April 1921 (*Turner*).

This is not a typical *Epyris*, owing to the groove joining the foveæ of the scutellum, but it is better placed here than in any other genus.

Parepyris bryanti, sp. n.

♀. Nigra, nitida; flagello fusco-ferrugineo; tegulis flavis; alis flavo-hyalinis, venis fulvis; segmento mediano septemcarinato. Long. 10 mm.

♀. Mandibles tridentate, the outer tooth only a little longer than the short second tooth, the inner tooth more deeply divided from the two outer teeth than they are from each other. Head subquadrate, much broader than the thorax; very distinctly, but not closely punctured, with a frontal groove from between the antennæ not reaching halfway to the anterior ocellus. Eyes separated from the hind margin of the head by a distance equal to about three-quarters of their length; posterior ocelli twice as far from the hind margin of the head as from each other. Scape about as long as the four basal joints of the flagellum combined, shining and sparsely punctured; flagellum stout, the two basal joints broader than long, the third a little longer than broad. Thorax rather sparsely punctured, also the sides of the median segment; pronotum longer than the mesonotum and scutellum combined; parapsidal furrows

very slightly convergent posteriorly; the two foveæ of the scutellum far apart and somewhat oblique. Median segment smooth, margined laterally and posteriorly, with seven longitudinal carinæ which are slightly convergent towards the apex, but curve near the apex towards the median carinæ, the space between the carinæ transversely striated, the two outer carinæ very close together; the surface of the posterior truncation smooth, with three low longitudinal carinæ very near each other. Abdomen smooth and shining, with a few small punctures and long fulvous hairs on the apical segments. Tarsal ungues with an acute tooth near the middle and another, blunter, near the base; intermediate tibiæ with short and close-set spines. Basal nervure nearly half as long as the radius, received at the base of the stigma.

Hab. Mt. Matang, Sarawak, 1000 ft., February 2, 1914
(*G. E. Bryant*).

Acanthepyrus propinquus, sp. n.

♀. Nigra; mandibulis tarsisque ferrugineis; segmentis abdominalibus quinto apice et sequentibus rufis; alis hyalinis, leviter infuscatis, venis fuscis.

Long. 5-8 mm.

♀. Head broader than long, rounded anteriorly, with large sparse punctures; a very short, longitudinal, impressed line from between the antennæ not reaching halfway to the anterior ocellus, posterior ocelli close to the hind margin of the head, which is feebly emarginate. Mandibles broadened at the apex, without teeth, the lower apical margin produced downwards, forming a short rostrum when the mandibles are closed. Scape about two and a half times as long as broad, with a close-set lateral row of spines; first joint of the flagellum a little longer than broad, second as broad as long. Pronotum as broad posteriorly as long, narrowed anteriorly, shining, with a few scattered punctures. Mesonotum without punctures, the median abscissa posteriorly not as broad as the lateral abscissæ, owing to the convergence of the parapsidal furrows. Scutellum almost impunctate, the lateral foveæ small. Median segment margined laterally and apically, almost smooth, with five longitudinal carinæ, the outer carinæ converging somewhat towards the apex, the space between the carinæ finely transversely striated; the surface of the posterior truncation slightly concave, with a low median carina, smooth in the middle, minutely punctured laterally; the sides of the segment slightly concave and

almost smooth. Abdomen smooth and shining, very finely punctured apically. The three basal joints of the fore tarsi have an apical spine which is as long as the succeeding joint, the basal joint has an additional spine in the middle; intermediate tibiae with many spines. Radius much longer than the basal nervure, the median vein prolonged a little beyond the basal cells. Tarsal unguis with a tooth near the middle.

Hab. S. Africa, Mossel Bay (*Turner*). A good series, taken in almost every month; Queenstown, 1 ♀, January 1923 (*Turner*).

This is very near *A. spinitarsis*, Kieff., from Portuguese Guinea, but differs in the sparse puncturation of the pronotum. Kieffer states that the pronotum in *A. spiniscapus*, Kieff., is coarsely and closely punctured and that *spinitarsis* does not differ in this point. It is quite probable that all three will prove to be races of one species.

Acanthepyris ceresensis, sp. n.

♀. Nigra; mandibulis, antennis pedibusque rufo-ferrugineis; segmentis abdominalibus tertio apice sequentibusque rufis; alis hyalinis, venis luteis, stigmate ferrugineo.

Long. 5-7 mm.

♀. Head as broad as long, rounded anteriorly, shining, the vertex smooth, the front above the base of the antennae with sparse piliferous punctures. Eyes separated from the hind margin of the head by a distance equal to two-thirds of their own length; posterior ocelli almost touching the hind margin of the head. Mandibles stout, blunt at the apex and without teeth. Scape twice as long as broad, flattened, with a row of slender spines on the inner margin and a few longer and stouter spines at the outer apical angle; the two basal joints of the flagellum short, the second as broad as long. Pronotum as broad posteriorly as long, shining and almost smooth, a row of large piliferous punctures along the lateral and anterior margins. Mesonotum as long as the scutellum, with a few scattered punctures, the parapsidal furrows almost parallel. Scutellum smooth and shining, the two basal foveae rather small. Median segment a little broader than long, margined apically and laterally, with three longitudinal carinae, the outer pair strongly convergent towards the apex, the space between the carinae transversely striate-rugulose, the remainder of the dorsal surface smooth; surface of the apical truncation almost smooth, scarcely concave; the sides of the segment finely aciculate. Abdomen shining, microscopically punctured. Tarsal unguis with one small tooth

near the middle; first joint of the fore tarsi with a row of five rather stout spines, the second and third strongly produced at the outer apical angle; fourth joint with two short spines, including one at the apical angle. Radius about twice as long as the basal nervure, rather strongly curved to one-third from the base, thence straight.

Hab. Cape Province, Ceres, February and March (*Turner*).

Allied to *A. hildebrandti*, Kieff., from East Africa, differing chiefly in the number and convergence of the carinæ of the median segment, and in the absence of spines on the second and third joints of the anterior tarsi. Although there are only three carinæ on the median segment, faint traces of two more can be seen near the base in some specimens.

Holepyris dolichocephalus, sp. n.

♀. Nigra, opaca; mandibulis, antennis, tegulis pedibusque luteo-ferrugineis; alis hyalinis, flavo pallidissime dilutis, venis luteis; segmento mediano quinque-carinato.

Long. 4 mm.

♀. Mandibles with two teeth at the apex, both of which are very small; antennæ stout, scape as long as the three basal joints of the flagellum; first joint longer than the second, which is as broad as long, the joints becoming broader towards the middle of the flagellum, sixth and seventh very distinctly broader than long. Head longer by one-third than its greatest breadth, coriaceous, eyes separated from the hind margin of the head by a distance fully equal to their own length, slightly hairy; posterior ocelli nearer to the hind margin of the head than to each other. Thorax coriaceous, pronotum a little broader posteriorly than long, strongly narrowed and distinctly margined anteriorly; mesonotum half as long as the pronotum, parapsidal furrows almost entirely obsolete. Basal groove of the scutellum well marked. Median segment a little longer than its greatest breadth, finely transversely striated, with five longitudinal carinæ, which are almost parallel, the two outer carinæ on each side are united by a short curved carina at about three-quarters from the base and are not continued to the apex; the surface of the apical truncation very closely and delicately transversely striated, with a median carina, the sides of the segment almost smooth. Abdomen shining, sparsely microscopically punctured on the apical tergites. Fore metatarsus curved, joints 2-4 of the fore tarsus short, the second scarcely longer than broad, the third and fourth more slender; tarsal

ungues with a small tooth before the middle. Radius nearly four times as long as the basal nervure.

Hab. Port St. Johns, Pondoland, June 1923 (*Turner*).

Holepyris pondo, sp. n.

♀. Nigra; mandibulis, clypeo nigro-carinato, antennis, tibiis anticis tarsisque ferrugineis; abdomine segmento quarto apice sequentibusque rufis; alis fuscis, fascia mediana hyalina.

Long. 5.5 mm.

♀. Mandibles bidentate at the apex; clypeus strongly compressed laterally, with an elevated longitudinal carina, projecting over the mandibles, the carina continued upwards on to the lower portion of the front. Head, pronotum, mesonotum, and scutellum very distinctly and rather closely punctured, the mesopleuræ more finely and very closely punctured. Head broader than long; eyes separated from the hind margin of the head by a distance equal to about half their own length; posterior ocelli separated from the hind margin of the head by a distance equal to their own diameter. Scape as long as the three basal joints of the flagellum combined, second joint of the flagellum one-quarter longer than the first, third one-quarter longer than the second, the first considerably longer than broad. Pronotum much broader than long, rounded anteriorly, coriaceous between the punctures; mesonotum more than half as long as the pronotum, the parapsidal furrows visible on the extreme anterior portion only; scutellum a little shorter than the mesonotum, the transverse basal groove deep and crenulate. A well-marked carina from below the tegula nearly reaching the base of the intermediate coxæ, bordering the metapleuræ anteriorly. Median segment transversely striate, with five longitudinal carinæ, the inner pair strongly convergent and joining the median carina at the apex, the outer pair almost parallel, the surface of the posterior truncation with a median carina. Abdomen smooth and shining. Femora stout; joints of the fore tarsus longer than broad; longer spur of the hind tibia not half as long as the metatarsus; tarsal unguis with a strong tooth near the middle. Radial nervure about three times as long as the basal, the latter not quite straight, slightly bent in the middle.

Hab. Port St. Johns, Pondoland, May 1924 (*Turner*).

Described from one specimen.

Holepyris vittatus, sp. n.

♀. Nigra, opaca; mandibulis, scapo, flagelli articulo basali, tegulis tarsisque anticis ferrugineis; tibiis anticis fusco-ferrugineis; alis fuscis, apice extremo hyalinis, in medio fascia lata hyalina..
Long. 5 mm.

♀. Mandibles tridentate at the apex, the outer tooth much longer than the others; scape curved, as long as the two basal joints of the flagellum plus half of the third, the first joint of the flagellum only a little shorter than the first. Head coriaceous, with fairly large and well-separated punctures, a short frontal groove from between the antennæ not reaching halfway to the anterior ocellus. Eyes without hairs, twice as long as their distance from the hind margin of the head; posterior ocelli as far from the hind margin of the head as from each other. Pronotum a little more finely punctured than the head, as long as its posterior breadth, narrowed anteriorly; mesonotum coriaceous and impunctate anteriorly, closely punctured posteriorly, the parapsidal furrows developed on the anterior half; just before the posterior margin of the pronotum is an impressed transverse line, on which is a row of large punctures. Scutellum almost smooth. Median segment broader than long, with two short spines at the posterior angles, with seven longitudinal carinæ, the space between the carinæ transversely striated, the first and second carinæ on each side distinctly, but not strongly, convergent towards the apex; the surface of the posterior truncation finely rugose, with a fine median carina. Mesopleuræ finely rugose; abdomen shining, microscopically punctured. Joints 2-4 of the fore tarsi much longer than broad; intermediate tibiæ without spines, tarsal ungues with a small tooth near the base. Radius more than three times as long as the basal nervure; the hyaline band of the fore wing extends from the basal cells to beyond the stigma.

Hab. Milnerton, near Cape Town, January 1926 (Turner).

Described from two specimens.

This is near *H. natalensis*, Kieff., but differs in the longer joints of the fore tarsus, in the sculpture of the median segment, the colour of the legs, and in the partially developed parapsidal furrows. The latter character indicates a very near approach to the genus *Rhabdepyris*.

Homoglenus sanctus, sp. n.

♀. Nigra, opaca; mandibulis, antennis tegulisque ferrugineis; femoribus fuscis, tibiis tarsisque luteis; alis hyalinis, venis fusco-ferrugineis.
Long. 5 mm.

♀. Mandibles not widened apically, the outer tooth a little longer than the inner. Head a little longer than broad, parallel-sided, finely and rather closely punctured. Eyes separated from the hind margin of the head by a distance equal to about half their length; posterior ocelli separated by less than their own diameter from the hind margin of the head. Scape not quite as long as the three basal joints of the flagellum combined; the second joint scarcely longer than broad, shorter than either the first or third, the latter longer than the fourth. Puncturation on the thorax as on the head, the pronotum longer than the mesonotum by one-third; parapsidal furrows well marked, slightly convergent posteriorly. Scutellum with two foveæ anteriorly, which are united by a shallow transverse groove. Median segment opaque, with three longitudinal carinæ, the two outer parallel until near the apex, where they curve abruptly and join the median carina at the apex; in the space between the carinæ is another less clearly defined carina on each side which does not reach to the apex, the dorsal surface of the segment is very finely rugulose, the posterior slope with a median groove, the sides of the segment and the pleuræ very delicately aciculate. Abdomen smooth and shining. Fore femora large and thickened, tarsal ungues with one tooth. Basal nervure joining the subcosta at the base of the stigma; radius a little less than three times as long as the basal nervure. The prolongation of the median nervure beyond the basal cells is indistinct; the lower discoidal cell is outlined both above and below, but not apically, by pale brown lines. The wings are clothed with very short microscopic hairs.

Hab. Port St. Johns, Pondoland, June 1923 (*Turner*).

Rysepyris silvatica, sp. n.

♀. Nigra, opaca; antennis, mandibulis pedibusque fusco-ferrugineis; alis hyalinis, brevissimis.
Long. 2-4 mm.

♀. Head longer than broad by about one-fifth, narrowed anteriorly, minutely and rather closely punctured. Eyes hairy, separated from the hind margin of the head by a distance equal to one and a half times their own length, malar space scarcely half as long as the eye. Mandibles simple, not dentate. Scape shining, a little longer than the two basal joints of the flagellum combined; first flagellar joint a little longer than the second, longer than broad; the remaining joints, except the apical one, broader than long. Pronotum a little longer than its greatest breadth, narrowed

and rounded anteriorly, much narrower than the head; mesonotum very short, scarcely more than half as long as the scutellum, the transverse groove of the latter deep and distinct; the whole thorax coriaceous, sparsely and minutely punctured. Dorsal surface of the median segment opaque, very delicately rugulose, with a well-marked longitudinal carina, longer than broad, about equal in length to the pronotum, margined laterally, but not apically. Abdomen smooth and shining, with a few minute punctures on the apical segments. Intermediate tibiae without spines; tarsal unguis simple. Wings reaching to the apex of the median segment, the median and submedian cells clearly defined, the subcosta fused with the costa, the radius shorter than the basal nervure and slender.

Hab. Port St. Johns, Pondoland, November to April (Turner).

A long series.

Taken by sweeping undergrowth in dense forest. *Plutobethylus transkeiensis* and a species of *Pristocera* were plentiful in the same locality, but, of course, in no way connected.

Arysepyris viduatus, sp. n.

♀. Nigra; mandibulis, antennis pedibusque fusco-ferrugineis. Long. 3.5–4.5 mm.

♀. Mandibles bidentate at the apex, not widened. Eyes very little longer than their distance from the hind margin of the head, with very short hairs; ocelli present, but very small, the posterior pair situated close to the hind margin of the head. First and second joints of the flagellum subequal, broader than long, the third longer than broad. Head distinctly longer than broad, sparsely and finely punctured, with a short frontal groove. Thorax with a few small scattered punctures; pronotum shorter than the head by about one-quarter, the sides almost parallel; mesonotum very short, only half as long as the scutellum, with distinct parapsidal furrows; scutellum with a transverse groove anteriorly. Median segment smooth, without punctures, slightly opaque, about equal in length to the pronotum, margined posteriorly and at the sides, without carinae, distinctly broadened from the base to the apex. Abdomen smooth and shining. Intermediate tibiae with short spines on the upper margin; tarsal unguis with a tooth near the middle. Wing rudimentary, about as long as the mesonotum and scutellum combined.

Hab. Van Reenen's Pass, Natal, 5600 ft., October to January (Turner).

Described from five specimens.

This is not a typical *Arysepyris*, differing in the presence of parapsidal furrows and of spines on the intermediate tibiae. In the characters of the median segment, however, it agrees well with the genus, and it is better to place it here. The hairs on the eyes are not easily seen.

Pristocera oriphila, sp. n.

♂. Niger; mandibulis ferrugineis, dentibus nigris; tergito apicali sternitoque apicali rufis; alis hyalinis venis luteis, stigmatibus costaque nigris.

Var. Mandibulis omnino nigris.

Long. 7-10 mm.

♂. Mandibles broadened at the apex, produced into a long lower tooth, above which are four smaller teeth decreasing in size towards the inner angle of the mandible, the outer side of the mandible strongly, but sparsely, punctured. Clypeus with a strong longitudinal carina. Head coarsely punctured, the front punctured-reticulate, the vertex shining and more distantly punctured; the head a little longer than its greatest breadth; malar space very short, not as long as the first joint of the flagellum; the eyes separated from the hind margin of the head by a distance about equal to their own length; a small smooth and shining space above the summit of the eye. Scape as long as the second and third joints of the flagellum combined, the second joint more than twice as long as the first. Thorax coarsely punctured, with the usual transverse impressed groove before the posterior margin of the pronotum; scutellum shining, with sparse punctures and with an impressed transverse line at the base. Median segment with two narrowly separated longitudinal carinae from the base to the apex converging at the extreme apex, the space between the carinae irregularly striate transversely; the apical portion of the segment very finely and closely transversely striated, the basal portion of the segment rather coarsely punctured reticulate with a few short, strong, longitudinal striae at the base. Metanotum shining, with several strong longitudinal carinae. Abdomen flattened, smooth, and shining, with a few pale hairs on the sides and at the apex. Neuration normal, but the veins at the apex of the lower discoidal cell are only faintly indicated. Tarsal ungues tridentate.

Hab. Van Reenen's Pass, Natal, 5600 ft., November and January (*Turner*).

Described from four specimens.

In the two specimens taken in January the mandibles are black.

Nearly related to *P. ruficaudata*, Westw., different in the lesser extent of the red colour on the abdomen, in the colour of the antennæ and legs, in the coarser sculpture of the head, and in the more obscurely defined lower discoidal cell. I took a specimen of *ruficaudata* at Kloof, Natal, in August 1926.

Subsp. *rhodesiæ*, nov.

♂. Differs from the typical form in having the head shining, much more sparsely and finely punctured, and in only having one distinct longitudinal carina on the median segment; this is due to the two carinæ approaching each other so nearly as to become more or less fused. The tarsi are ferruginous, the femora and tibiæ fusco-ferruginous, more or less stained with black.

Hab. Sawmills, S. Rhodesia, December 1926. From the Rhodesia Museum.

Pristocera hirsutula, sp. n.

♂. Niger, crasse punctatus; mandibulis quinque-dentatis; alis hyalinis, leviter infuscat, venis fuscis.
Long. 10-11 mm.

♂. Mandibles strongly punctured, much broadened apically, with five teeth, the outer tooth the longest, the inner blunt and directed upwards, the three intermediate teeth small. Clypeus transverse, with a distinct median carina, smooth and shining. Head distinctly broader than long, very coarsely punctured-rugose, the punctures more distinctly separated on the vertex than on the front. Eyes separated from the hind margin of the head by a distance nearly equal to their length; malar space very short, smooth, and shining. Thorax coarsely punctured; pronotum short, punctured rugose, with a transverse groove behind the middle, the anterior margin raised, forming a carina. Median lobe of the mesonotum shining, with large scattered punctures, the mesonotum longer than the pronotum. Scutellum rather sparsely punctured, with a depressed transverse line anteriorly. Metanotum longitudinally striated, with a small enclosed area in the middle densely clothed with short whitish hairs. Median segment longitudinally depressed in the middle, with a carina from base to apex, the depressed groove transversely striated; at the base of the segment is an imperfectly enclosed semicircular area, broken

by the median depression and coarsely rugose-striate longitudinally; the remainder of the segment more finely obliquely striated, not margined. Abdomen flattened, smooth, and shining, with rather long whitish hairs at the apex. Tarsal ungues with two small teeth, one in the middle, the other near the base. Antennæ rather short, about as long as the thorax and median segment combined, the scape curved, the second joint of the flagellum more than twice as long as the first and a little longer than the third. The apical vein of the lower discoidal cell is distinctly defined, though not as strongly as the others; the anal nervure is continued to the margin of the wing; a rather indistinct nervure, broken in the middle, extends from the upper outer angle of the lower discoidal cell, joining the radius a little before the middle.

Hub. Drakensberg, Van Reenen's Pass, December and January (*Turner*).

Described from two specimens.

Much more coarsely punctured than *P. decemdentata*, Enderl., from which it differs also in the colour of the mandibles and the lesser development of their teeth, as well as in other details. The hairy patch on the metanotum is remarkable.

Pristocera draconum, sp. n.

♂. Niger, punctatus; alis hyalinis, venis fuscis.
Long. 6-7 mm.

♂. Mandibles punctured, broadened to the apex, with five teeth, the outer one fairly long, the inner one stout, the others short. Clypeus depressed, transverse, with a rather low carina. Antennæ rather short, scarcely reaching backward to the hind margin of the mesonotum. Scape punctured, almost as long as the three basal joints of the flagellum combined, second and third flagellar joints equal, more than half as long again as the first, which is almost as broad as long. Head shining, with large but not very close punctures, broader than long; eyes separated from the hind margin of the head by a distance about equal to their own length; posterior ocelli more than twice as far from the hind margin of the head as from each other. Pronotum shorter than the mesonotum, narrowed anteriorly, strongly punctured, with a transverse depression before the hind margin; median lobe of the mesonotum almost smooth, the lateral lobes strongly punctured, the parapsidal furrows only slightly convergent posteriorly; scutellum smooth and shining, with a transverse groove anteriorly; pleuræ coarsely and closely punctured. Median segment finely rugulose, with an irregular

low carina from base to apex, on each side at the base are two short low carinæ; the sides of the segment very finely and closely obliquely striated. Abdomen smooth and shining. Tarsal unguis with a tooth near the middle and another near the base, both acute and well developed. Submedian cell distinctly longer than the median, basal nervure long, joining the subcosta just before the base of the stigma; radius only half as long again as the basal nervure; lower discoidal cell only faintly defined on the outer and lower sides.

Hab. Van Reenen's Pass, Natal, 5000 ft., October to January (Turner).

This is a smaller species than either *hirsutula* or *oriphila*, both of which occur in the same locality. It differs much from the former in sculpture, and from the latter both in sculpture and colour.

Pristocera juncta, sp. n.

♂. Niger, nitidus; mandibulis antennisque ferrugineis; scapo fusco; tegulis tarsisque fusco-ferrugineis, abdomine segmento quarto apice sequentibusque rufo-ferrugineis; alis hyalinis, venis luteo-ferrugineis, stigmatibus costaque fusco-ferrugineis.

♀. Castanea; capite thoraceque sparse punctatis; capite elongato rectangulari.

Long., ♂, 7 mm.; ♀, 4.5 mm.

♂. Mandibles punctured, broadened to the apex, with five black teeth, the three intermediate teeth small. Head a little longer than broad; with large punctures, more or less confluent on the front, more widely separated on the vertex. Eyes separated from the hind margin of the head by a distance equal to their own length, posterior ocelli more than twice as far from the hind margin of the head as from each other. Second joint of the flagellum twice as long as the first, equal to the fourth. Pronotum coarsely punctured, with a deep transverse depression before the hind margin, broader anteriorly than its greatest length, much widened posteriorly. Mesonotum longer than the pronotum, the median lobe smooth with a few lateral punctures, the lateral lobes with large, but rather sparse, punctures; parapsidal furrows strong and finely crenulate. Scutellum with a transverse groove anteriorly, smooth, finely punctured posteriorly. Median segment transversely striate-rugulose, with several low, irregular, convergent, longitudinal carinæ which do not quite reach the apex, the space between these carinæ more coarsely sculptured, the posterior truncation almost

vertical. Mesopleuræ rather strongly punctured, sides of the median segment rugose. Abdomen smooth and shining, flattened. Tibiæ without spines, tarsal ungues with an acute tooth close to the middle and another blunt close to the base. Radial nervure twice as long as the basal; the latter long and slightly curved, joining the subcosta a little before the hyaline spot at the base of the stigma. The apical and lower margins of the lower discoidal cell are not clearly defined.

♀. Mandibles broadened to the apex, with three teeth, the outermost one the longest. Scape a little longer than the four basal joints of the flagellum combined, all the joints of the flagellum except the apical one broader than long, the whole antenna longer than the head by one-fifth. Head rectangular, about half as long again as broad, shining, very sparsely punctured, not quite twice as broad as the thorax. Pronotum sparsely punctured, only a little more than half as long as the head, distinctly longer than its greatest breadth, narrowed anteriorly. Mesonotum wanting, scutellum and median segment smooth and shining, the scutellum nearly half as long as the pronotum; the median segment as long as the pronotum, strongly emarginate at the base to receive the apex of the scutellum, broadened towards the apex. Abdomen smooth and shining. Intermediate tibiæ spinose, tarsal ungues simple. The eyes are small and round, the ocelli wanting.

Hab. St. Johns, Pondolond, September 1923 (*Turner*).
♂ ♀ *in cop.*

Pristocera gaullei, Kieff.

Pristocera gaullei, Kieff. Bull. Soc. Metz, xxv. p. 2 (1908). ♂.

Specimens taken by me at Port St. Johns, Pondoland, answer fairly well to the description of this species, though possibly a local race. The typical form is from Dahomey, and I have not seen a specimen.

Pristocera sinhalensis, sp. n.

♂. Niger; mandibulis extus basi linea lutea; alis hyalinis, venis fuscis; segmento mediano area basali rectangulari.
Long. 7.5 mm.

♂. Mandibles with four apical teeth, the outer one acute and much longer than the three inner, which are very short. Antennæ rather short, the scape finely punctured, as long as the three basal joints of the flagellum combined, second joint of the flagellum twice as long as the first, scarcely

longer than the fourth; the scape and basal half of the flagellum with a row of long pale hairs beneath; the whole antenna shorter than the thorax and median segment combined. Clypeus transverse at the apex, sparsely punctured, with a short longitudinal carina at the base. Head a little broader than long, rounded at the posterior angles, coarsely, but not very closely, punctured; eyes separated from the hind margin of the head by a distance only slightly more than two-thirds their own length. Pronotum much narrower than the head, rather sparsely punctured, the apical margin rather broadly depressed. Mesonotum short, the middle lobe shining, with two large punctures on each side, the lateral lobes with several deep punctures; the parapsidal furrows twice as far apart anteriorly as posteriorly. Median segment not margined, with a rectangular, very finely rugulose space at the base enclosed by carinæ; from this space oblique carinæ radiate outwards on each side; the apical three-fifths of the segment before the posterior truncation rather finely transversely striated, a little depressed medially, with a median longitudinal carina, and a carina on each side, the latter very distinctly converging towards the apex; the surface of the posterior truncation longitudinally striate-rugose, the sides of the segment striated; pleuræ strongly punctured. Abdomen flattened, smooth, and shining, minutely punctured on the apical tergites. Tarsal ungues with two teeth on the inner margin. The veins enclosing the lower discoidal cell are colourless apically and below.

Hab. Ceylon, Peradeniya, September (*A. Rutherford*).

Plutobethylus transkeiensis, sp. n.

♂. Niger; mandibulis flagelloque ferrugineis; pronoto postice propleurisque sordide ferrugineis; scapo, tegulis pedibusque luteis; tergitis primo secundoque lateribusque indistincte luteo-maculatis; alis hyalinis, leviter flavo-suffusis; venis luteis, stigmate fusco suffuso.

Long. 3-6 mm.

♂. Antennæ long, two-thirds of the length of the whole insect; scape short, no longer than the second joint of the flagellum. Clypeus with two longitudinal carinæ; mandibles slender, acute at the apex. Head subquadrate, malar space short, eyes separated from the hind margin of the head by a distance equal to their own length; posterior ocelli twice as far from the hind margin of the head as from each other. Head coarsely punctured, coriaceous between the punctures, the front with an impressed line from the anterior ocellus

nearly reaching the base of the antennæ. Pronotum finely punctured, much broader posteriorly than long, strongly narrowed and rounded anteriorly, without a transverse groove. Mesonotum and scutellum sparsely, shallowly, and finely punctured, parapsidal furrows strong throughout; a depressed transverse line at the base of the scutellum, the whole thorax subopaque. Median segment with a carina running from the base to the apex, with a few delicate oblique striæ near the basal angles; mesopleuræ punctured-rugose; sides of the median segment coriaceous. Nervures of the lower discoidal cell subobsolete; basal nervures joining the subcostal far before the stigma. Tarsal ungues without teeth. Abdomen flattened, shining. The eyes are not hairy.

Hab. Port St. Johns, Pondoland (*Turner*). Taken in almost all months.

Kieffer records the genus from South America only, but this seems to be quite nearly allied to the species he places in the genus.

Subfamily ANTEONINÆ.

Tribe LESTODRYINI.

Lestodryinus cariniceps (Cam.).

Dryinus cariniceps, Cam. Zeitschr. Hym. vi. p. 158 (1906).

Two specimens of this species taken by me at Port St. Johns, Pondoland, in May and June 1923, differ from a specimen marked "Type" by Cameron in the British Museum in the larger size (6 mm.), and in having the scutellum black instead of red. This species is omitted in Kieffer's monograph of the family.

Lestodryinus deceptor, sp. n.

♀. Fulvo-ochracea; unguiculis nigris; alis hyalinis, leviter infumatis, anticis fascia hyalina mediana, venis flavis. Long. 5 mm.

♀. Mandibles with four teeth, the outermost tooth the longest. Scape more than half as long again as the first joint of the flagellum, second joint more than twice as long as the scape and first joint combined, and half as long again as the third joint, and more than twice as long as the fourth. Clypeus deeply incised at the apex, front very feebly concave between the eyes, vertex flat. Head subopaque, very finely and closely punctured, a carina from the anterior ocellus not reaching the base of the antennæ. Eyes large, distinctly

divergent towards the vertex; posterior ocelli separated from the hind margin of the head by a distance scarcely equal to the diameter of an ocellus. Pronotum longer by one-fifth than the mesonotum and scutellum combined, constricted posteriorly, the hind margin emarginate, finely punctured, propleuræ distinctly longitudinally striated. Mesonotum and scutellum finely coriaceous, parapsidal furrows not very distinct apically, nearly parallel. Median segment fully as long as the mesonotum and scutellum combined, rugose-reticulate, the dorsal surface with several irregular longitudinal striæ; abdomen smooth. Hind metatarsus as long as the four apical tarsal joints combined; lateral spur of the fore tarsus with a small tooth just before the apex, and with an even row of minute spines on the inner margin, the medial spur with a very close row of hair-like lamellæ. Neuration as in *L. cariniceps*, Cam.

Hab. Port St. Johns, Pondoland, February and December (Turner).

Described from two females.

In addition to the very different colouring, the longitudinal striæ of the propleuræ distinguish this species at once.

Lestodryinus ampuliciformis, sp. n.

♀. Fulvo-ochracea; tarsi intermediis posticisque articulo apicali carinaque verticali nigris; alis hyalinis, flavo-dilutis, venis flavis. Long. 3.5-4.5 mm.

♀. Mandibles with four teeth, the outermost tooth much the longest. Scape fully twice as long as the first joint of the flagellum, second joint three times as long as the first and half as long again as the third. Posterior ocelli separated from the hind margin of the head by a distance exceeding considerably their own diameter. A carina extends from the anterior ocellus two-thirds of the way to the base of the clypeus; head rugose, the rugosities with more or less tendency to form longitudinal striæ; vertical carina very strong, also continued on the sides of the head; the antennæ are rather short, not extending backwards beyond the scutellum. Pronotum much narrower than the head, half as long again as the mesonotum, strongly prolonged at the hind angles, shining and without clearly defined sculpture, propleuræ posteriorly with very delicate pale golden pubescence; remainder of the thorax finely rugose; metanotum well developed, quite two-thirds of the length of the scutellum; parapsidal furrows shallow and only visible anteriorly; a crenulate transverse line on the anterior margin both of the

scutellum and the metanotum. Median segment coarsely reticulate, broader than long, only two-thirds of the length of the pronotum, the posterior slope almost vertical. Abdomen smooth and shining. Lateral pincer of the fore tarsus with a row of minute teeth on the apical half, and a distinct tooth just before the apex; median pincer with a close-set row of hair-like lamellæ. The four apical joints of the hind tarsus combined are half as long again as the metatarsus. Second abscissa of the radius more than half as long again as the first, basal nervure as long as the second abscissa of the radius.

Hab. Port St. Johns, Pondoland, May to August 1923 (Turner). A good series taken.

This is not a typical *Lestodryinus*, differing in the distinctly convex vertex, the less distinct parapsidal furrows, and the shorter median segment. In colour it is very similar to *deceptor*.

Neodryinus erraticus, sp. n.

♀. Nigra; antennis fusco-ferrugineis, articulo apicali ochraceo; clypeo lateribus, mandibulis basi tegulisque fusco-ferrugineis; pedibus fuscis; alis anticis fuscis, basi extrema, fascia lata ante venam basalem fasciæque latiore post cellulas hyalinis, venis nigris stigmatæ macula basali alba.

Long. 4 mm.

♀. Mandibles with four teeth, the two outer teeth rather long, the inner much shorter. Scape short, second joint of the flagellum nearly four times as long as the first and more than half as long again as the third; the antennæ rather short, not reaching backwards as far as the metanotum. Head concave between the eyes, flat on the vertex, eyes distinctly convergent towards the clypeus; posterior ocelli almost touching the hind margin of the head; a carina from the anterior ocellus not reaching the base of the antennæ. Head opaque, finely and very closely punctured. Pronotum shining and almost smooth, margined anteriorly, about as long as the mesonotum and scutellum combined; mesonotum finely punctured anteriorly, the remainder and greater portion coarsely rugose, without parapsidal furrows; scutellum shining, sparsely and very finely punctured. Metanotum short, not more than half as long as the scutellum, with short longitudinal striæ; mesopleuræ rugose. Median segment coarsely reticulate, the sides of the segment obliquely striated; the segment about equal in length to the pronotum. Abdomen smooth and shining. The apical four joints of

the hind tarsi combined are half as long again as the metatarsus. Lateral joint of the pincers of the fore tarsus pale luteous, with a row of ten minute spines, the medial joint with a row of similar spines. Radius about one-third longer than the basal nervure; second abscissa of the radius more than twice as long as the first; the transverse cubital nervure pale and rather indistinct, but quite visible through its entire length.

Hab. Mossel Bay, Cape Province, October to February (Turner).

Described from three specimens.

Psilodryinus rugidorsalis, sp. n.

♀. Nigra; mandibulis, clypeo, antennis, tegulis, abdomine pedibusque ferrugineis; tarsis intermediis posticisque luteis, articulis apice extremo ferrugineis; alis anticis basi usque ad venam basalem fusco-hyalinis, dimidio apicali hyalinis, macula magna fusca sub-stigmate; venis fuscis, stigmate basi macula alba. Long. 4 mm.

♀. Antennæ short, scarcely reaching backwards to the scutellum; second joint of the flagellum half as long again as the third. Clypeus broadly rounded at the apex. Head, seen from the front, very broadly triangular, closely longitudinally striated, the eyes large and very prominent; the front between the eyes strongly concave, also the posterior slope of the head behind the vertex. Hind margin of the head strongly emarginate, the posterior ocelli almost touching the hind margin. Pronotum as long as the mesonotum and scutellum combined, delicately aciculate, with an almost smooth space behind the middle and an impressed transverse line just before the middle, the hind angles not produced and very far from the tegulæ. Mesonotum and scutellum rather coarsely longitudinally rugose-striate; parapsidal furrows obsolete; metanotum very short, less than half as long as the scutellum, strongly crenulate; mesopleuræ rugose-reticulate. Median segment very coarsely longitudinally striated, the striæ strongly raised, the posterior slope rather abrupt and coarsely reticulate, the segment shorter than the pronotum. Abdomen smooth and shining. Fore coxæ and trochanters elongate, together as long as the femora, the trochanters very slender at the base. Lateral pincer of the fore tarsi with a short row of minute teeth, medial pincer with a closer-set row of small lamellæ. Four apical joints of the hind tarsus combined more than half as long again as the metatarsus. Stigma lanceolate; radius

short, a little shorter than the basal nervure, transverse cubital nervure well defined, the first abscissa of the radius a little shorter than the second.

Hab. Port St. Johns, Pondoland, November and December 1923 (*Turner*).

Described from two females.

The armature of the pincers consists of a close-set row of short lamellæ on the median branch; the lateral branch is almost unarmed, the teeth being little more than hairs, four in number, set far apart, with a tooth just before the apex.

Tribe ANTEONINI.

Chelogynus maritimus, sp. n.

♀. Nigra; mandibulis, flagello, propleuris pedibusque anticis fusco-ferrugineis; scapo, tegulis tarsisque anticis luteis; alis hyalinis, anticis fusco bifasciatis, venis fuscis, stigmatè basi albido.

♂. Niger; mandibulis, scapo, tegulis, tibiis anticis, tarsisque, articulo apicali excepto, luteis; femoribus anticis fusco-ferrugineis; alis hyalinis, venis incoloratis, stigmatè venaque radiali pallide luteis.

Long., ♀, 2.5 mm.; ♂, 2 mm.

♀. Scape a little longer than the two basal joints of the flagellum combined, the first and third flagellar joints subequal, the second a little longer, the apical joints increasing in thickness. Vertex rather strongly punctured, with delicate, irregular, transverse striæ between the punctures; front rather coarsely rugose-reticulate, with a longitudinal median carina from the anterior ocellus and a carina along the inner margin of the eyes; the whole head sparsely clothed with short white hairs. Thorax shining and almost smooth; mesonotum twice as long as the pronotum, the parapsidal furrows shallow and inconspicuous, mesopleuræ rugose. Median segment with a small enclosed basal area in which are a few longitudinal striæ; on either side a larger area which is broadly rounded posteriorly and reticulate; the posterior slope of the segment finely rugose. Abdomen smooth and shining. Fourth joint of the fore tarsi much longer than the first, lateral pincer of the fore tarsus unarmed, median pincer with a close-set row of lamellæ extending in the middle over nearly half the length of the pincer. First abscissa of the radius less than twice as long as the second, the transverse cubital nervure almost obliterated. The fuscous bands of the fore wing consist of a narrow one on the basal nervure and a broad one extending

from before the base of the radius to beyond its apex. The maxillary palpi are at least five-jointed.

♂. Mandibles tridentate; scape as long as the two basal joints of the flagellum combined plus half of the third, second and third joints of the flagellum subequal, the whole antennæ sparsely clothed with long hairs. Sculpture very similar to that of the female. Pronotum very short, shorter than in the female and depressed somewhat below the level of the mesonotum. Wings entirely hyaline, veins translucent; the stigma very large, pale luteous; radius extending very little beyond the junction of the subobsolete transverse cubital nervure, first abscissa of the radius three times as long as the second. Maxillary palpi five-jointed.

Hab. Milnerton, Cape Town, January and February 1926 (Turner). A long series taken.

As I took numbers of both sexes on the same bushes on the coast, and no other related species, I think the association of the sexes is certain.

XI.—*Note on the Synonymy of Mytilaspis flava, Targ., var. hawaiiensis, Mask. By E. ERNEST GREEN, F.E.S., F.Z.S.*

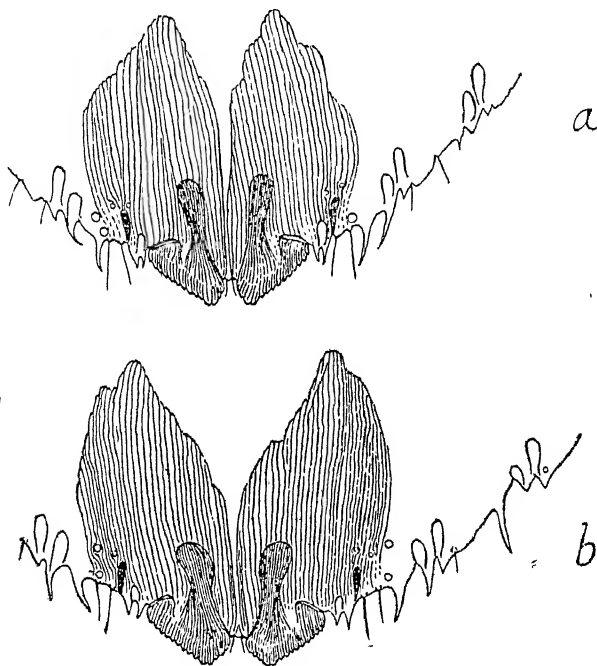
THE name *Mytilaspis* of Signoret has for many years been recognized as a synonym of *Lepidosaphes*, Shimer.

Mrs. Fernald, in her 'Catalogue of the Coccidæ of the World,' places *hawaiiensis* as a subspecies of *flava*, Targ., and adds a note to the effect that "Kirkaldy thinks that *flava* and *hawaiiensis* are the same, and probably a variety of *Lepidosaphes ulmi*."

I have no acquaintance with Targioni's description of *flava*. Signoret ('Essai sur les Cochenilles,' p. 141) gives a very brief and inadequate description of the species, comparing it with *linearis*, Mod., which is now regarded as a synonym of *ulmi*. Kirkaldy may (or may not) have been correct in referring *flava* to the same species, but in coupling it with Maskell's var. *hawaiiensis* he must have spoken without any knowledge of the insect itself, or of Maskell's description of his supposed variety, which draws particular attention to the conspicuous clavate paraphyses that are characteristic of *hawaiiensis*.

I fortunately possess material of *hawaiiensis* received direct from Maskell himself, and I am in a position to assert that this insect is not only amply distinct from *ulmi*, but that it is equally distinct from any other species described prior to

Maskell's publication. The same insect was, however, redescribed under the name of *moorsi* by Doane & Ferris, whose material came from "trunks of orange-trees, near Apia, Samoa." Maskell's material was from "the Sandwich Islands, on bark of trees." He also records it from China, on *Pyrus sinensis*. I have now received examples of *hawaiiensis* from Dr. A. Balachowski, who found it occurring upon the bark of *Lagerstroemia indica* at the Jardin d'Essai, Algiers.



a. Pygidium of adult ♀ of *Lepidosaphes moorsi*, × 450.
b. Ditto of *Mytilaspis flava-hawaiiensis*, × 450.

I think that comparison of the accompanying figures will suffice to establish the identity of the supposed two species. The figure of *hawaiiensis* (b) is from material ex coll. W. M. Maskell, that of *moorsi* (a) is from a preparation ex coll. G. F. Ferris.

The synonymy of the species would accordingly appear to be:—

Lepidosaphes hawaiiensis (Mask.).

Mytilaspis flava-hawaiiensis, Mask. N.Z. Trans. xxvii. p. 47 (1894).
Lepidosaphes moorsi, Doane & Ferris, Bull. Entom. Research, vi. 4, p. 401 (Feb. 1916).

XII.—*A new Thomasomys from Rio Grande do Sul.*

By OLDFIELD THOMAS.

IN 1886 Dr. H. von Ihering sent to the British Museum two baby rats which, in founding *Hesperomys* (afterwards *Thomasomys*) *pyrrhonotus* *, I referred to Wied's *Mus pyrrhorhinus*, a member of the genus *Oryzomys*. Being mere babies, however, any certainty was impossible, and I am now interested to find that at about the same time Ihering sent both young and adult to the Genoa Museum, and these, by the kindness of Dr. O. de Beaux, I have now had the opportunity of examining. To my surprise the species proves not to be *pyrrhorhinus*, which is a true *Oryzomys*, but is a *Thomasomys*, and represents a new species from an area where members of the latter genus had never previously been known.

Thomasomys ænax, sp. n.

A medium-sized species of the most typical—*cinereus*—section of the genus.

General colour above pale lined grey, but the pallor probably increased by the fact that the specimen had been skinned out of spirit. Under surface light, whitish to the bases of the hairs on throat and inguinal regions; broadly washed with strong buffy on the belly, though this also may have been affected by spirit; basal half of belly-hairs deep slaty; lateral line of demarcation not sharply marked. Nose and hairs of ears bright ochraceous rufous. Hands and feet of the same ochraceous colour in the British Museum specimens, which have remained in spirit, paler, more yellowish white in the two skinned-out Genoa specimens, but the ochraceous colour is probably the true one, as this type of coloration is known elsewhere. Tail long, short-haired throughout, brown, little lighter below than above.

Skull of typical *Thomasomys* shape, not unlike that of *T. taczanowskii*, though with rather longer face; inter-orbital region narrow, its edges rounded. Zygomatic plate little projected forward. Palatal foramina long, to the middle of m^1 . Bullæ rather large, though not approaching those of *pyrrhonotus*. Incisors orthodont.

Dimensions of the type (as measured in Genoa on the skinning of the specimen):—

Head and body 110 mm.; tail 181; hind foot 29; ear 20.

Skull: greatest length 31; condylo-incisive length 28;

* Ann. & Mag. Nat. Hist. (5) xviii. p. 421.

zygomatic breadth 16·5 ; nasals 11 ; interorbital breadth 4 ; breadth of brain-case 14 ; palatilar length 12·8 ; palatal foramina 7 ; bulla, oblique diameter 4·5, upper molar series 5 5.

Hab. Rio Grande do Sul. Type from San Lorenzo.

Specimens examined : four—one adult and one young secured through the Museo Civico, Genoa, and two young ones received direct by the British Museum ; probably all one family, mother and three young.

Type. Adult female. B.M. no. 27.11.19.44. Genoa Museum number 3284. Collected by Dr. H. von Ihering. Received in exchange from the Genoa Museum.

This species, both in its characters and locality, differs from any known member of the genus, most *Thomasomys* being from north-west South America. The “pyrrhorhine” coloration, which occurs in isolated species of so many Muridæ both in S. America and Africa, has not hitherto been found in *Thomasomys*. The history of the family of specimens, sent home to two museums more than forty years ago, but only now reunited and discriminated, is also of interest.

From the superficially similar *Oryzomys pyrrhorhinus*, Wied, to which I originally referred our young specimens, the new species is at once distinguishable by its rounded unridged supraorbital edges, that animal having a very characteristically ridged *Oryzomys* skull. So far as is yet known, *O. pyrrhorhinus* ranges from Ceara to Minas Geraes, its record from S. Brazil being now invalidated.

XIII.—On Notonectidæ from Central Africa (*Hemiptera-Heteroptera*). By G. E. HUTCHINSON, Department of Zoology, University of the Witwatersrand, Johannesburg.

THE following descriptions and records are based on material from two sources :—

(1) A collection from various parts of Africa belonging to the British Museum, submitted to me for determination through the kindness of Mr. W. E. China.

(2) A collection made at Kampala, Uganda, by Mr. G. L. R. Hancock and Mr. H. Hargreaves, sent to me for examination by the former.

To all these entomologists I am greatly indebted, but particularly to Mr. China for his invaluable assistance with literature.

In the Uganda collection there are no fewer than ten

determinable species of *Anisops*, which I believe to be the greatest number so far recorded from any locality. This number could probably be increased, as some of the undeterminable females appear to belong to unrecognized new species, and the widely distributed *A. varia*, Fieb., found throughout Africa, is absent from the collection. Mr. Hancock tells me that the Kampala insects are "mostly from clay-pits (like the Cambridge ones) in somewhat similar fenny country (*Mariscus*, various grasses, and sometimes papyrus)."

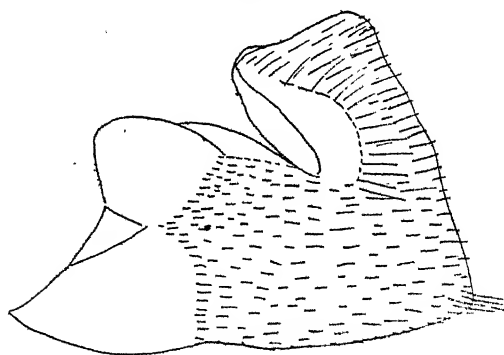
In the present paper are given descriptions of eight new species known to me only from these collections, together with notes on a few known forms and undeterminable specimens. Species occurring south of the Zambezi will be described in a forthcoming revision of the Notonectidæ and Corixidæ of South Africa.

The figures are somewhat diagrammatic camera lucida drawings, many irrelevant hairs being omitted.

1. *Enithares rhodopis*, sp. n.

Yellowish grey, eyes greyish chocolate, pronotal foveæ almost entirely pale, with irregular dark brown markings on

Fig. 1.



Enithares rhodopis, sp. n. ♂ gonital capsule (type).

their upper borders. Greatest breadth of head 2·7 times that of vertex, which is 2·5 times as wide as synthlipsis. Pronotum just under three times as wide as long, slightly wrinkled transversely. Scutellum just over once and two-thirds as long as the pronotum.

Anterior leg with the tibia twice as long as the tarsus, first

tarsal joint just under once and two-thirds as long as the second, which is a little shorter than the longer claw.

Intermediate leg with the tibia once and a half as long as the tarsus, first tarsal joint once and three-fifths as long as the second, which is a little longer than the longer claw.

♂. Anterior tibia not darkened below. Genital capsule large and of characteristic form (fig. 1).

L. 8 mm.

♂, White Nile (*L. Loat*), 1906–197 B.M. (*type*).

E. rhodopis differs from *E. sobria*, Stål, in its almost concolorous pronotal foveæ, in the rather longer first intermediate tarsal joint, in the uniformly pale anterior tibia of the ♂, and in the large genital capsule. In the first and third of these characters it approaches an undescribed South-African species, from which it differs in its slightly smaller size and markedly in the form of the genital capsule. All the described African species of *Enithares* appear to have black or smoky markings in the antero-lateral foveæ.

2. *Enithares* sp.

Allied to the above, but differing in the entirely yellow pronotal foveæ and the narrower synthlipsis, which is but a third as wide as the vertex. First joint of intermediate tarsus just over half as long again as the second.

♀, Abutshi R., Nigeria, 1903–198 B.M.

Examination of a ♂ would probably indicate this to be a new species.

3. *Anisops adonis*, sp. n.

Greyish white, anterior part of scutellum darker, abdomen blackish.

♂. Head about one-sixth of its width (or rather less), narrower than the pronotum; vertex between one-fifth and one-sixth as wide as the head and twice as wide as the synthlipsis. Facial tubercle slightly compressed laterally and continued up as a faint carina, which divides, forming the raised edges of a longitudinal fovea on the notocephalon.

Pronotum just over twice as wide as long and two-thirds as long as the scutellum. Anterior tibia with a small stridulatory comb of seven to nine distinct teeth, rather short, with two longer and one short bristle on the upper edge, and three long basal and shorter distal hairs on the lower, about half as long again as the tarsus, which is three and a half times as long as the longer claw (fig. 2). Intermediate tibia about twice and a third as long as the first tarsal joint, which is

about half as long again as the second, longer claw a little more than half as long as the latter.

♀. Head wider than in ♂, about one-eighth narrower than the pronotum and just over five times as wide as the vertex. Facial tubercle obsolete. Pronotum about twice and a quarter as wide as long. Anterior legs with tibia about half as long again as the tarsus; first tarsal joint rather less than twice as long as second (14:8·5). Intermediate leg much as in ♂.

L. 5·5 mm.

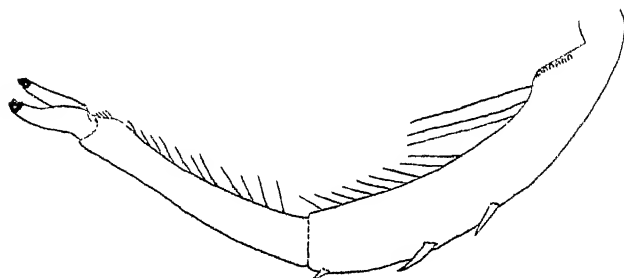
♂ ♀, N. Nigeria, Zungeru, 23. viii. 1910, B.M. 1911-110 (*J. J. Simpson*) (*type* and *allotype*).

2 ♂ ♂, Uganda, Kampala, 30. i. 1927 (*H. Hargreaves*).

The Uganda specimens have a darker scutellum than the Nigerian; the latter are possibly a little teneral.

The only species hitherto described from West Central

Fig. 2.



Anisops adonis, sp. n. Anterior leg, ♂ (*type*).

Africa is *A. aphrodite*, Kirkaldy (Ann. Soc. Ent. Belge, xlv. p. 435, 1900, but omitted in his list, Wien. Ent. Zeit. xxiii. 1904), from Kinchassa, Lemba, and Boma. *A. adonis* differs from *aphrodite* in its wider synthlipsis, which in the latter species is but one-fourth as wide as the vertex, and in the longer anterior tibia of the ♂, which in *A. aphrodite* is but once and a quarter as long as the tarsus. In his 1904 paper (Wien. Ent. Zeit. xxiii.) Kirkaldy states that *Anisops vitrea*, Sign., is distributed throughout the Ethiopian region, and the same statement is made by Horvath (Ark. för. Zool. xviii. no. 31, 1927), who records a specimen from the Sudan. I have never taken or seen a specimen of this species in Africa, but know it only from Madagascan material. I cannot help thinking that some confusion has occurred between *vitrea* and *adonis* or one of the related species

described below, and that the former does not occur throughout the African continent.

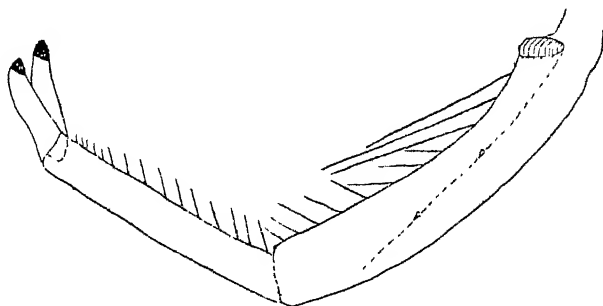
4. *Anisops psyche*, sp. n.

Notocephalon greyish or dirty yellow, scutellum blackish basally, particularly near the sides, but the extreme anterior angles orange or pale greyish yellow, posterior part greyish yellow or orange, fading to pale yellow apically; dorsum abdominis black, posteriorly with sutures pale or orange, elytra hyaline.

♂. Head between one-sixth and one-eighth of its width narrower than the pronotum, and from rather less than four and a half to over five times as wide as vertex, which is approximately twice the synthipsis.

Facial tubercle deeply and widely excavated, leaving only

Fig. 3.



Anisops psyche, sp. n. Anterior leg, ♂ (type).

two lateral walls on its upper side, which converge above to form a single carina. This shows traces of bifurcation, becoming the very slightly raised sides of a just detectable longitudinal depression on the notocephalon. The main excavation of the tubercle is cut off from a triangular area within the converging walls by a slight subsidiary transverse carina.

Pronotum twice as wide as long or rather less. Scutellum half as long again as pronotum or rather less.

Anterior tibia with two peg-like hairs and several short bristles basally on its upper margin, and three long basal and a few shorter hairs on the lower, with comb of small transverse lamellæ; about once and two-fifths as long as the tarsus, which is twice and two-thirds as long as the longer

claw (fig. 3). Intermediate tibia about twice and a quarter as long as the first tarsal joint, which is about half as long again as the second, the latter half as long again as the longer claw.

L. 6 mm.

2 ♂♂, Uganda, Kampala, 30. i. 1927 (*H. Hargreaves*) (*type*), and 23. ii. 1927 (*G. L. R. Hancock*).

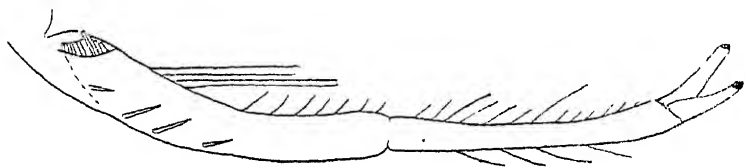
This little species is at once distinguished from the last and the next two by the form of the facial tubercle.

5. *Anisops eros*, sp. n.

Notocephalon dirty yellow; scutellum sooty, anteriorly laterally and posteriorly dirty yellow; dorsum abdominis black, posterior sutures pale; elytra hyaline.

♂. Head between one-sixth and one-eighth of its width narrower than the pronotum, and just under six times as wide as the vertex, which is twice and a third to twice and two-thirds as wide as the synthlipsis. Facial tubercle slight,

Fig. 4.



Anisops eros, sp. n. Anterior leg, ♂ (*type*).

simple, neither compressed nor excavated. Notocephalon slightly longitudinally foveate anteriorly.

Pronotum just under twice as wide as long, smooth, posterior margin bisinuate. Scutellum one-seventh to one-fourth as long again as the pronotum. Anterior tibia with a few hairs on the upper margin, not conspicuously thickened and bristle-like, and three long basal and shorter more distal hairs on the lower, comb narrow, with a few of the more distal elements transversely elongate; about once and a third as long as the tarsus, which has three short spines in a row basally and is from rather over twice and a half to three times as long as the longer claw (fig. 4). Intermediate tibia about twice and a third as long as the first tarsal joint, which is once and a third to once and a half as long as the second, longer claw half as long as the latter.

L. 5.8 mm.

3 ♂♂, Uganda, Kampala, 20. iii. 1927 (*G. L. R. Hancock*) (*type* and two *paratypes*).

Superficially not certainly distinguishable from the last two or the next species.

6. *Anisops amaryllis*, sp. n.

Grey; scutellum pale greyish yellow, darker antero-laterally; basal (claval) margin of elytra narrowly crimson.

♂. Subparallel, tapering posteriorly.

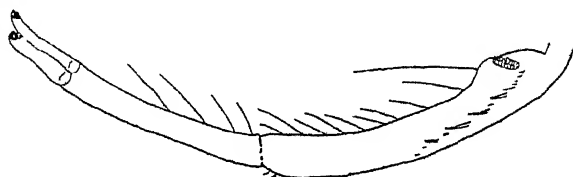
Head about one-tenth narrower than the pronotum and about six and one-third times as wide as the vertex, which is just under twice and a half as wide as the synthlipsis.

Facial tubercle slight and simple.

Pronotum about twice as wide as long, posterior margin bisinuate.

Scutellum just under half as long again as the pronotum.

Fig. 5.



Anisops amaryllis, sp. n. Anterior leg, ♂ (*type*).

Anterior tibia with four spinous hairs between smaller hairs on the distal half of the upper margin, and three (apparently) long basal hairs and shorter more distal ones on the lower; stridular comb on a prominent eminence, each lamella broad, short, and elongate, dumbbell-shaped when viewed from above, about half as long again as the tarsus, which is just over three times as long as the longer claw (fig. 5). Intermediate tibia twice as long as the first tarsal joint, which is just over half as long again as the second, longer claw half the latter.

L. 6 mm.

♂, British East Africa (now Kenya Colony), Nairova Pass (*C. S. Betton*), B.M. 1901-185 (*type*).

The unique type is somewhat teneral and its head is somewhat shrunk. This species is closely allied to *eros*, but differs notably in its narrower stridulatory comb.

7. *Anisops kampalensis*, sp. n.

Greyish white.

♂. Fusiform, stoutish, widest about the first third of the elytra—i. e., about the middle of the body.

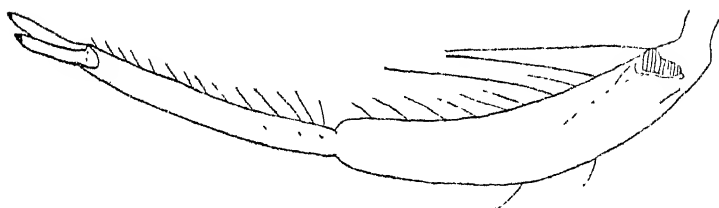
Width of head and pronotum subequal, vertex about one-fifth as wide as the former and a little more than four times as wide as the synthlipsis.

Facial tubercle simple and rather flat; face with an almost obsolete carina between the eyes, which divides to form a pair of barely distinguishable raised areas on the anterior part of the notocephalon.

Pronotum without carina, with an irregular row of hairs at about the posterior quarter, posterior margin with a narrow and slight central sinuation; about once and two-thirds as wide as long, and subequal in length to the scutellum.

Anterior leg with tibia about half as long as the tarsus,

Fig. 6.



Anisops kampalensis, sp. n. Anterior leg, ♂ (type).

which is about three times as long as the longer claw, upper edge of tibia with about four very fine, short, spine-like hairs, lower edge with three long basal and shorter hairs; stridulatory comb of about eleven lamellæ, the distal ones being elongated; tarsus with three peg-like hairs in a row basally (fig. 6). Intermediate tibia twice as long as the first tarsal joint, which is half as long again as the second, claw just over half as long as the latter.

L. 6 mm.

♂, Uganda, Kampala, 20. iii. 1927 (G. L. R. Hancock) (type).

In the same collection is a second specimen which I regard as belonging to this species, though differing considerably from the type as follows:—Widest across the pronotum, head about one-tenth narrower than the latter, vertex just over one-sixth as wide as the head and about three times as

wide as the synthlipsis. The armature of the front leg seems to be the same in both specimens and warrants their inclusion in a single species, though in the paratype the anterior tibia is but once and a quarter as long as the tarsus. A further series of specimens should prove interesting. It is just possible that this form is referable to *A. aphrodite*, in spite of the latter's somewhat smaller size ("5½ mm.," *vide* Kirkaldy), for the ratios of the vertex and synthlipsis in the type and those of the anterior leg in the paratype agree with that species. Until material from West Africa is available or the types can be examined it is probably better to keep *kampalensis* distinct.

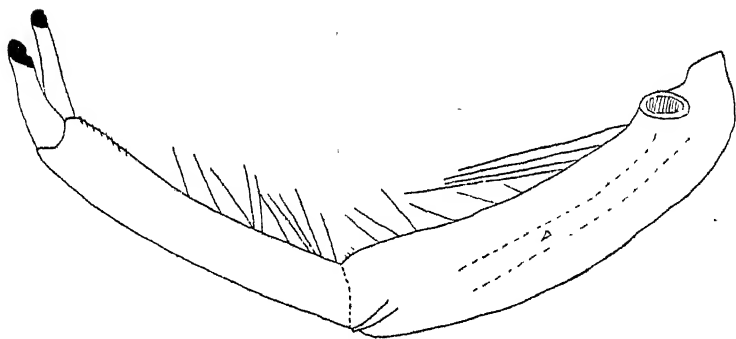
8. *Anisops hancocki*, sp. n.

Greyish white.

Rather a robust subparallel species.

Head one-fifth to one-sixth of its width narrower than the pronotum and four to five times as wide as the vertex, which is between once and a half to twice as wide as the synthlipsis.

Fig. 7.



Anisops hancocki, sp. n. Anterior leg, ♂ (type).

Facial tubercle deeply excavated, leaving a pit with two curved ridges above on either side, these ridges bending upwards internally above the middle of the excavation towards the vertex and becoming obsolete. Pronotum rather over once and three quarters as wide as long, smooth, posterior margin bisinuate.

Scutellum from just over once to once and a half as long as the pronotum.

♂. Anterior tibia with a small peg in the middle and

a bristle apically on the upper margin, and three long basal and shorter more distal hairs on the lower margin; stridulatory comb small but well developed, ovoid; about once and one-seventh to once and one-third as long as the tarsus, which is twice and two-thirds to just over three times as long as the longer claw (fig. 7). Intermediate leg with tibia about twice as long as the first tarsal joint, which is once and two-thirds to twice as long as second, claw half the latter.

L. 8-8.5 mm.

2 ♂♂, Uganda, Kampala, 20. iii. 1927 (G. L. R. Hancock) (*type* and *paratype*).

I have much pleasure in dedicating this interesting species to its discoverer, Mr. G. L. R. Hancock, whose collection has thrown so much light on the Notonectidæ of Central Africa. *A. hancocki* may be distinguished from all other African species save *psyche* by its excavated cup-shaped facial tubercle. From *psyche* it may be easily separated by its much larger size as well as by many details of the more minute structure of the anterior leg, facial tubercle, etc.

9. *Anisops sardea*, H.-S.

1 ♀, Uganda, Kampala, 30. i. 1927 (H. Hargreaves).

The form, slightly foveate facial tubercle, and rather well marked groove on the notocephalon leave little doubt that this ♀ specimen belongs to *sardea*.

10. *Anisops nivea*, F.

♂♂, ♀♀, Uganda, Kampala, 30. i. 1927 (H. Hargreaves), 1. ii. 1927 and 20. iii. 1927 (G. L. R. Hancock).

These specimens are 10.5-11 mm. long and are similar to Madagascan ♀♀ in the British Museum collection. Investigation of adequate material from Asia and Africa would almost certainly show that *nivea* is a composite species and that some of its many synonyms should be revised.

11. *Anisops ares*, sp. n.

Notocephalon yellowish; pronotum yellowish anteriorly, with the centre and posterior part black to black with the middle of the anterior margin paler; scutellum black, with the extreme anterior angles reddish orange or entirely black; elytra with clavus and an area on the base of the membrane and the apex of the corium black, basally with crimson mottling.

Fusiform, widest across the pronotum; head from about one-sixth to very slightly narrower than the pronotum and five to six times as wide as the vertex, which is rather less or rather more than twice as wide as the synthlipsis.

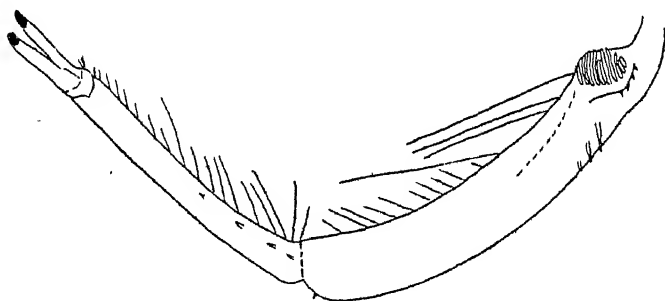
Notocephalon anteriorly with traces of a longitudinal fovea; facial tubercle simple and low.

Pronotum once and five-eighths to twice as wide as long.

♂. Pronotum from just under to more than half as long again as scutellum.

Anterior leg with tibia once and a third to once and a half as long as the tarsus, which is just over three times as long as the claw. Upper edge of tibia with three small spines basally and one apically, and four very small spines above the stridulatory comb; lower edge with four long basal hairs and shorter distal ones; comb of about eleven lamellæ, very transversely elongate and not much longer than broad; tarsus with a row of four small spines proximally (fig. 8).

Fig. 8.



Anisops ares, sp. n. Anterior leg, ♂ (type).

Intermediate tibia just over twice as long as the first tarsal joint, which is about half as long again as the second, claw half as long as the latter (47:22:14:7).

♀. Scutellum from just over as long as to half as long again as the pronotum.

Anterior leg with tibia about once and a quarter as long as the first tarsal joint, which is just under half as long again as the second; claw just under half as long as the latter.

Intermediate leg with tibia rather more than twice as long as the first tarsal joint, which is about half as long again as the second, claw about half as long as the latter or rather more (allotype 49:21:13:8).

Uganda, Kampala, ♂ (mature, *type*) and 3 ♂ ♂ (teneral), 20. iii. 1927; 2 ♀ ♀ (mature, *allo-* and *paratype*) and 1 ♀ (teneral), 20. iii. 1927; 1 ♀ (mature, *paratype*), 23. iii. 1927.

This species can only be confused with *A. varia*, Fieb., and was at first taken to be a melanistic form of that species. It differs, however, in the form of the stridulatory comb, which is a far narrower and more compact structure in *varia*. In the latter species, moreover, the synthipsis is proportionately narrower.

The specimens before me, in so far as one can judge from small numbers, indicate that the females become fully coloured before the males. The teneral individuals are white except for a smoky patch in the apical part of the corium and base of the membrane. In one the scutellar pigment has partially developed, but not that of the clavus or pronotum. In all the red spotting at the extreme base of the elytra is apparent.

The types of all the new species described in this paper will be forwarded to the British Museum unless belonging already to that institution.

BIBLIOGRAPHICAL NOTICES.

Manual of British Birds. By HOWARD SAUNDERS. Third Edition, revised and enlarged by WILLIAM EAGLE CLARKE, I.S.O., LL.D. 834 pages, with 405 Illustrations. Published by Gurney and Jackson. 30s. net.

SAUNDERS'S 'Manual of British Birds,' a volume compiled from Yarrell's larger work on 'British Birds,' is, perhaps, one of the best of the many manuals on British ornithology, but it is now twenty-eight years since the last edition of the Manual appeared, and during these twenty-eight years ornithology has so advanced that a book which in 1899 was the last thing possible is now so out of date, especially in nomenclature, that its value from a scientific point of view is almost nil. In addition to this, the system of nomenclature has been entirely altered, and the trinomial system is now universally accepted—that is to say, we now acknowledge the existence of subspecies or geographical races. The consequence is that, whereas the 2nd edition of the Manual contained less than 400 species of birds, the present contains 500 species and subspecies. Nor is this increase due only to the admittance of subspecies, for of late years there have been many additions to British ornithology in the way of casual or single visitors not previously recorded.

The present edition will be welcomed by all ornithologists, and the fact that it has been brought out by Dr. Eagle Clarke is in itself a guarantee that the work has been well and thoroughly done. Each species has been dealt with exhaustively and in a sequence containing distribution, both local and extra-limital, nidification, general habits, and, finally, a description of the bird itself. For a manual with a definite limit in space, each of the headings mentioned has been satisfactorily dealt with, whilst Dr. Eagle Clarke's personal intimate knowledge of the birds of Great Britain has enabled him to give all the information which is necessary or new whilst dispensing with the redundant. We can congratulate the editor on having brought out a work useful to the scientist, almost invaluable to the field-worker, and yet pleasing to the lay reader.

There is, perhaps, only one matter for regret in this work, and that is that Dr. Eagle Clarke has not fully accepted the nomenclature adopted by the Committee of the British Ornithologists' Union, for we must admit that we cannot always understand the editor's nomenclature. For instance, for each species he gives us a binomial title, and then underneath this he gives us the trinomial, showing which race it is and whether resident in, or a visitor to, England. This method, however, he does not adopt consistently throughout the book. Thus, on page 155, we see that he calls the Northern Willow-Titmouse "*Parus borealis*." Now, surely, if the author wishes us to use binomials only, this must be *Parus atricapillus*, and the binomial used as the author uses it means nothing. Yet again, we regret to see that Dr. Eagle Clarke retains a few of the *nomina conservanda* for reasons which he says are desirable, but does not explain. An instance of this is the name of the Song-Thrush, which he still calls "*Turdus musicus*." It is a pity, perhaps, that Dr. Clarke has not given his reasons more fully for using these names, but we are sure that, whatever they are, they would not satisfy the modern ornithologist. We can well sympathise with the author in his regrets at the disappearance of names which we have known from our childhood, but if we will only make up our minds without exception to use the names we know, or believe to be, correct according to the laws of priority, future generations will have an easy task. If, however, some of our leading ornithologists, like the author, will still insist on using names which are out of date, and which we know to be incorrect, the difficulties of our descendants will be greatly increased.

Still, as we have said, the Manual is an excellent one, is very badly wanted, and has been brought out in a manner which will render it an acquisition to any working library. The general excellence of its format and its generally great scientific accuracy perhaps only serve to accentuate the few faults to which we have ventured to draw attention. Finally, it is only fair to say that Mr. Grönvold's beautiful illustrations, which are given in addition to the old woodcuts, are well worthy of a place in the book. The

printing is good and clerical errors very few, but the paper is very heavy, and the Manual is for this reason somewhat cumbersome to handle.

Enzymes, Properties, Distribution, Methods, and Application. By SELMAN A. WAKSMAN, M.S., Ph.D., and WILBURT C. DAVISON, M.A., M.D. 8vo. Pp. xii, 364, text-figs. 10. Baillière, Tindall & Cox, 1927. Price 25s.

THE authors have endeavoured to collect in a concise form the available information in regard to enzymes, and to indicate the original sources from which more detailed knowledge may be obtained. The literature of the subject is vast: over two thousand references have been consulted, and in their efforts to piece these together in a connected whole the authors have produced a volume which from its condensed form will be more helpful to the teacher or advanced worker than to the general student. As a book of reference the volume will be invaluable. The scientific development of the subject is comparatively modern. The name enzyme (from the Greek *ενζύμη*, in leaven) was suggested in 1867 by Kühn for all unorganised or unformed ferments, emphasizing the distinction between fermentations which occurred only in immediate contact with the living cell and enzyme-action which occurred when separated from the cell. The demonstration that an enzyme could be separated from the living cell, as shown in the case of the yeast, and still be effective, removed the difference supposed to exist between ferment and enzyme. An enzyme is defined as a catalyst (*i.e.*, any substance which alters the rate of a reaction that otherwise would be comparatively slow) produced by living organs and cells as distinguished from an inorganic catalyst, which is a definite chemical substance. Inorganic catalysts are definite chemical substances, but the chemical structure of enzymes is still unknown.

The subject-matter is divided into four sections:—A. Properties of enzymes; B. Distribution of enzymes; C. Methods for their preparation and study; and D. Practical applications of enzyme activity. The distribution of enzymes is considered under three headings—those found in the human and animal body, and those found respectively in the higher and lower plants (micro-organisms—bacteria, fungi, etc.). In Section C enzymes are grouped for study according to their action, those acting upon fats and ethers, those acting upon carbohydrates or proteins and their derivatives, oxidases, zymases, and, lastly, catalase, which decomposes hydrogen peroxide into water and inactive molecular oxygen. Section D is a résumé of the various economic uses of enzyme-action.

A useful feature of the book is an extensive Bibliography, which fills nearly eighty pages.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[TENTH SERIES.]

No. 2. FEBRUARY 1928.

XIV.—*A Contribution towards the Insect Fauna of French Oceania.*—Part II. By L. EVELYN CHEESMAN, F.Z.S., F.E.S.

THE material for this paper forms part of the St. George Collection made upon two groups of islands in the South Pacific: namely, the Tuamotus and the Marquesas; also of my own collection from three islands of the Society group.

For the work which I have personally done on this material in the following paper and in Part I. (*Trans. Ent. Soc.* p. 147, 1927), and in papers published elsewhere, I have gratefully to acknowledge the aid of a research grant from the Royal Society.

DERMAPTERA.

1. *Chælisoches (Forficula) morio*, F., *Syst. Ent.* p. 270 (1775) (Tahiti).

Marquesas Is.: Nuku-hiva, 1 ♂, Jan. 1925 (*St. George Exp.*). Society Is.: Tahiti, Fautaua Valley, 1 ♂; Lake Vaihira, at 1200 ft., 1 ♀, 1925 (*L. E. C.*).

Numerous among coconut-shells and rubbish on the coast; also in the valleys on the under surface of "taro" leaves.

The life-history of this species has been fully worked out by Terry, Exp. Sta. Hawaiian Sugar Plan. Asso. Div., *Ent. Bull.* i. pt. 5, p. 164, pls. viii. & ix. (1905).

Ann. & Mag. N. Hist. Ser. 10. Vol. i. 12

2. *Chelisoches* sp.

Society Is.: Tahiti, sea-level, 1 ♂; Lake Vaihiria, 1 ♀, in a tree-hole among rotting leaves. (One ♀ taken on Hiva-oa, Marquesas Is., is possibly a variety of this species.)

3. *Sparattina* (*Spongiphora*) *nigrorufa*, Burr, Termes. Fuzet. xxv. p. 4, pl. xx. fig. 3 (1902) (New Guinea).

Society Is.: Raiatea, Valley Vairurumai, 5 ♂♂, 4 ♀♀. Numbers in flight apparently disturbed by the recent cutting of low scrub in a vanilla plantation.

4. *Labia* (*Forficelisa*) *curvicauda*, Motsch. Bull. Soc. Nat. Moscow, xxxvi. pt. ii. p. 2, pl. ii. fig. 1 (1863).

Marquesas Is.: Nuku-hiva, ♂ ♀, under bark at 2000 ft., Jan. 1925 (*St. George Exp.*). Society Is.: Raiatea, 2 ♂♂ at light, at sea-level, May 1925 (*L. E. C.*).

This small species is widely distributed throughout tropical and sub-tropical regions.

"This species I have found in Hawaiian Islands abundantly on plants imported from Samoa."—*R. C. L. Perkins*.

5. *Anisolabis* (*Forficula*) *annulipes*, Lucas, Bull. Soc. Ent. France, (2) v. p. lxxxiv (1847).

Marquesas Is.: Nuka-hiva, 5 ♀♀; Iiiva-oa, 1 ♂ (1 ♂? var.); Fatu-hiva, 1 ♂, Jan. 1925 (*St. George Exp.*). Society Is.: Tahiti, Lake Vaihiria, 2 ♀♀, in a tree-hole with rotting leaves (one ♀ with immaculate femora); Vallée de la Mission, 2 ♀♀. Common under stones on all these islands.

6. *Sphingolabis* (*Forficula*) *hawaiiensis*, Born. Ann. Mus. Civ. Stor. Nat. Gen. xviii. p. 341, 3 figs. (1883).

Tahiti, Papenoo Valley, March 1925 (*L. E. C.*).

7. *Anisolabis* (*Forficula*) *maritima*, Géné, Ann. Sci. Nat. Regn. Lomb. Venet. ii. p. 224 (1832).

Taken in a nest with eggs in a crack of a tree, Vallée de Ste. Amélie at 3000 ft.

My thanks are due to Dr. R. C. L. Perkins for kindly naming some of these species.

HYMENOPTERA (ACULEATA).

APOIDEA.

Megachilidæ.

1. *Megachile diligens*, Sm. Journ. Linn. Soc., Zool. xiv. p. 684 (1879) (Honolulu).

Megachile doanei, Ckll. Ent. News Phil. xix. p. 466 (1908) (Tahiti).

Tuamotu Arch.: Napuka, 1 ♀, Feb. 1925 (*St. George Exp.*). Society Is.: Raiatea, 1 ♂; Bora Bora, 2 ♂ ♂, 1 ♀, June 1925 (*L. E. C.*).

Not numerous. All specimens from the Society Is. were taken on the blossoms of a trailing bean near the shore.

2. *Lithurgus (Megachile) scabrosus*, Sm. Journ. Proc. Linn. Soc. iii. p. 134 (1858) (Aru Is.).

Megachile albofimbriatus, Sichel, Reise Novara, Zool. ii. pt. 1, p. 151 (1867) (Tahiti).

Specimens from Tahiti were compared with the type (♀) from the Saunders Collection in the Hope Museum at Oxford.

In 1908, Kohl (Denk. Akad. Wiss. Wien, Bd. lxxxi. p. 308) added the following emendations to the original description:—"Die Gesichtstuberkel ist ganz gut ausgebildet, darum trifft der Ausdruck 'fronte subtuberculata' nicht zu. Die Behaarung des Prothorax ist grossenteils weiss, ebenso sind es Stellen auf dem Mittelsegment und neben dem Schildchen, und daher ist der Thorax nicht streng 'nigricanti pilosus' zu nennen. Schwarzlich ist vorzuglich die Behaarung der Thoraxseiten und des Brust."

Marquesas Is., Nuku-hiva, 1 ♂, 1 ♀; Hiva-oo, 3 ♀ ♀, Jan. 1925 (*St. George Exp.*). Society Is.: Tahiti, Papeete, 2 ♀ ♀, 8. iii. 25; Papenoo, 2 ♀ ♀, 15. iv. 25; Taravau, 1 ♀, 9. vii. 25; Raiatea, 1 ♀, 10. v. 25; Bora Bora, 1 ♂, 2 ♀ ♀, 10. vi. 25 (*L. E. C.*). Specimens in the B.M. from Fiji, Samoa, Rarotonga.

Numerous on all the islands. The "hu-hu" (Tahitian); nests in door-posts, beams, etc.

SPHECOIDEA.

Sphegidæ.

3. *Sceliphron (Pelopæus) camentarium*, Drury, Illustr. Nat. Hist. i. p. 105 (1770).

Pelopæus tahitensis, Sauss. Reise Novara, Zool. ii. p. 67 (1867) (Tahiti).

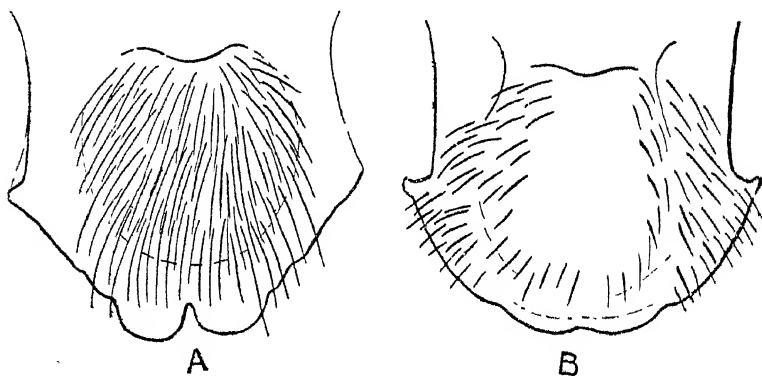
Marquesas Is.: Nuku-hiva, Fatu-hiva, Hiva-oo, 3 ♂ ♂,

5 ♀ ♀, Jan. 1925 (*St. George Exp.*). Society Is.: Tahiti, 1 ♂, 4 ♀ ♀; Raiatea, 1 ♂, 1 ♀, March–May 1925 (*L. E. C.*).

Yellow markings very variable; the four specimens from Tahiti appear to be var. *lunatum*, F. From Fatu-hiva, in two specimens (♂ ♀) the propodeon and first abdominal tergite are entirely black, and in two ♀ ♀ the yellow marking is present on the propodeon but not on the first tergite. Both of these forms occurred together on Raiatea near Uturoa.

One ♀ taken upon Bora Bora exhibits aberrant characters. The clypeal margin, instead of being distinctly bilobed as in the typical form, is obsoletely emarginate; the disc bare in the centre. The long dark brown hair of the head,

Fig. 1.



Sceliphron œmentarium, Drury.

A. ♀ clypeus. B. ♀ clypeus—aberrant specimen.

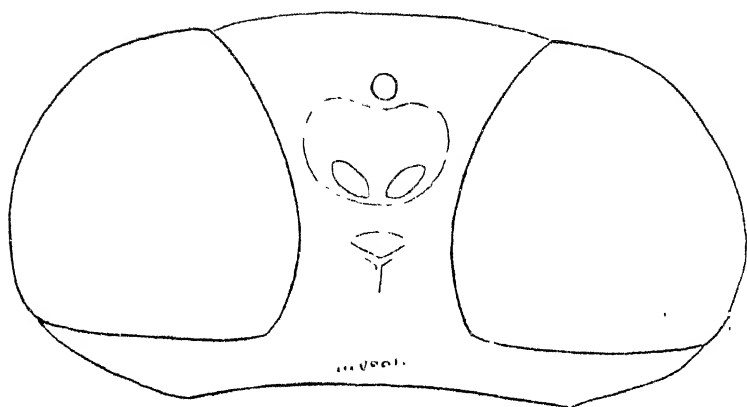
pleuræ, coxæ, and trochanters is replaced by short bristles (see fig. 1, A & B).

Distribution. Central and N. America: introduced into Hawaii, Madeira, Cuba, Barbadoes. There are records of females having built their nests upon ships in harbour, which indicates one means by which this species has been distributed.

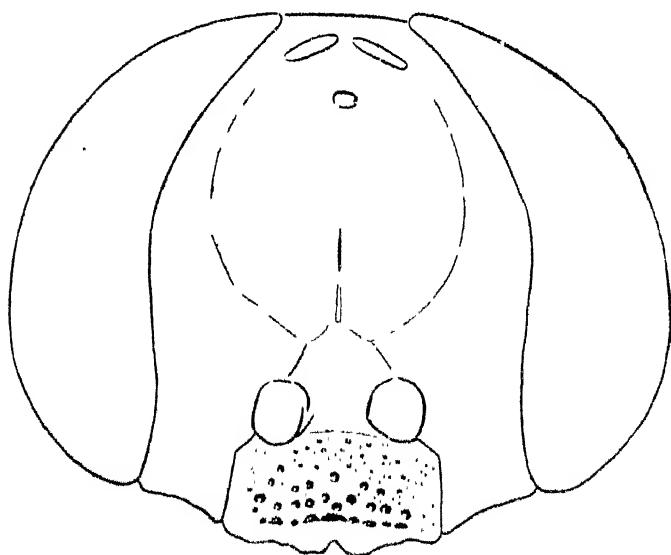
4. *Tachysphex fanuensis*, sp. n.

Black; the lower part of the face, sides, and clypeus covered with silver pubescence; sparse on the rest of the head and the thorax. Mesopleuræ, sides of the propodeon,

Fig 2.



A.



B.

Tachysphex famiensis, sp. n.
A & B. ♀ head.

and the anterior femora with longish silver pilosity. Abdomen and legs sparsely pubescent; first to third tergites with silver transverse fasciæ.

Head sparsely and finely punctate, the space between the punctures minutely granulate. Clypeus transversely and deeply impressed behind the anterior margin, which is shining and coarsely punctate, the apex produced into two blunt teeth (see fig. 2, A & B). Eyes strongly convergent on the vertex, the interocular space on the vertex being one-third of that on the clypeus. Frons with a longitudinal impression, which is less distinct on the ocellar swelling and vertex; a short but deep transverse sulcus behind the posterior ocelli. Second segment of the antennæ twice as long as the first, ~~the third segment slightly longer than the second.~~

Puncturation of the mesonotum rather denser than on the head. Scutellum shining with fine regular punctures. Dorsal area of the propodeon flattened with a slight median impression, and fine, obscure, longitudinal striation, the space between the striæ minutely reticulate-punctate; the length three times that of the scutellum. Posterior face with a deep median sulcus not reaching the basal articulation, and a transverse carina distinctly produced, curving downwards at the outer end, on each side near the anterior margin.

Tergites of abdomen dull; pygidium glabrous, length greater than the width at the base, irregularly punctate. The three apical sternites and a triangular area on the second sternite shining. Anterior tarsal comb pale, the teeth not long. Length of the first abscissa of the radius slightly less than half that of the third, which is almost three times the length of the second.

Length 10 mm.

♂ as in ♀, but silver pubescence of the face denser.

Ventral surface of the abdomen not shining, sparsely pubescent. The two apical tergites narrowed, covered with thin silver pubescence; the seventh tergite with the lateral apical angles acutely dentate.

Length 8.5 mm.

Tuamotu Arch.: Fakarava, 2 ♂♂, 1 ♀, Jan. 1925 (*St. George Exp.*). Society Is.: Tahiti, 3 ♂♂, 15. iv, 1. v, 2. vii. 1925; Raiatea, 9 ♂♂, May-June 1925; Bora Bora, 3 ♂♂, 4 ♀♀, June 1925 (*L. E. C.*).

Numerous on the Society Is., flying on the coast roads together with *Pison ignavum*, *P. tahitense*, and *Oxybelus uturoæ*. On the coast-hills above Fanui several females were making their burrows on patches of dry soil, and stocking

them with a small cockroach, *Blattella notulata*, Stål (described from Tahiti by Br. von Wattenwyl under the name of *Phyllodromia hieroglyphica*). I dug out one burrow. Dry pellets of soil were loosely piled at the entrance, so that a piece of grass had to be rammed down the burrow to prevent the first part from falling in, although the wasps crawl in with their victims without damaging the structure. The burrow examined sloped at an angle for about half an inch, then the passage turned vertically for an inch and a half with another sharp angle at the end of the passage; it finished in a horizontal shaft with two dead cockroaches, one of which had the wasp's egg attached to the end of the body. I saw one *Tachysphex* catch its prey by dropping upon it swiftly from above. The Blattid was sitting openly on the leaves, as is the habit of this species. I happened to be attempting to take it myself with a net, but the wasp's movement was swifter, and they rolled off together into the dense herbage where I lost them. Dr. Perkins has kindly drawn my attention to the fact that it is not unknown for members of this genus to prey upon Blattids, this being the food of the rare British *T. lativalvis*, Thoms.

Trypoxyloniidæ.

5. *Pison hospes*, Sm. Journ. Linn. Soc., Zool. xiv. p. 676 (1879).

Marquesas Is.: Hiva-oo, 1 ♀; Tahuata, 1 ♀; Nuku-hiva, 1 ♀, Jan. 1925 (*St. George Exp.*). Society Is.: Raiatea, 1 ♂, 2 ♀ ♀, 26. v., 4. vi. 25.

One of the above specimens was taken feeding upon (apparently) the excretions of Coccids.

Specimens in the B.M. Coll. from Singapore, Hawaii, and Cocos-Keeling.

6. *Pison tahitense*, Sauss. Reise Novara, Zool. ii. pt. 1, p. 66 (1867) (Tahiti).

Pison rechingeri, Kohl, Denk. Akad. Wiss., Wien, Bd. lxxxi. 1908, p. 309 (1908).

Marquesas Is.: Fatu-hiva, 2 ♀ ♀, Jan. 1925 (*St. George Exp.*). Society Is.: Tahiti, Vallée de Ste. Amélie, and Valley Vaitepitiha, 1 ♂, 2 ♀ ♀, 15. iv. 25 & 11. viii. 25; Bora Bora, 2 ♀ ♀, 3. vi. 25 (*L. E. C.*).

Distribution. Fiji, Samoa, Ellice Is.

7. *Pison iridipennis*, Sm. Journ. Linn. Soc., Zool. xiv. p. 676 (1879).

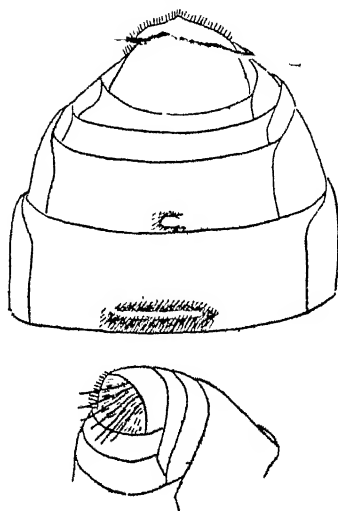
Marquesas Is.: Hiva-oa, 1 ♀; Tuamotu Arch., Fakarava, 1 ♀, Jan. 1925 (*St. George Exp.*). Society Is.: Bora Bora, 2 ♂♂, June 1925 (*L. E. C.*).

One specimen bred out of the cells of *Sceliphron camentarium*.

Dr. Perkins has drawn attention to the tubercle on the third abdominal sternite of the ♂ by which this species may be distinguished from any other species of *Pison*.

Specimens in the B.M. coll. from Samoa, Hawaii, and Fiji.

Fig. 3.



Pison impunctatum.

♂. Ventral abdominal segments.

8. *Pison impunctatum*, Turner, Ann. & Mag. Nat. Hist. (8) ix. 1912, p. 200.

Type B.M. ♀ (New Guinea).

Marquesas Is.: Hiva-oa, 5 ♀♀; Fatu-hiva, 2 ♀♀, Jan. 1925 (*St. George Exp.*). Society Islands: Tahiti, Taïarapu, 2 ♀♀, 7, 12. viii. 25; Bora Bora, 1 ♂, 19. vi. 25 (*L. E. C.*).

♂. The distance between the posterior ocelli and the eyes slightly greater than in the ♀; third sternite of the abdomen with a transverse tubercle, as in *iridipennis*, fourth sternite with a small round tubercle (see fig. 3).

"Probably closely allied to *strictifrons*, Vachal (New Caledonia), also to *iridipennis*, Sm. From the latter it differs in the lesser distance between the eyes on the vertex, and the smoother median segment."—Turner (loc. cit.).

9. *Pison argentatum*, Sh., subsp. *ignavum*, Turn. Proc. Zool. Soc. p. 457 (1908) (Queensland).

Marquesas Is.: Iiiva-ou, 2 ♀ ♀; Fatu-hiva, 1 ♀, Jan. 1925 (*St. George Exp.*). Society Is.: Tahiti, 2 ♀ ♀, March 1925; Raiatea, 1 ♂, 10 ♀ ♀, May and June 1925 (*L. E. C.*).

Distinguished from *argentatum* (Mauritius, Honolulu) by the slightly more rounded clypeal apex in the ♂.

This species is very numerous on the Society Is. and the Marquesas Is., where these wasps build cells of clay pellets, usually choosing a sheltered position on walls, inside buildings, or under the eaves, against flat surfaces under overhanging rocks, suspended in clusters from exposed roots, in the interstices between the cells of *Sceliphron*, or on the under surfaces of leaves, etc.

10. *Pison* sp.

Dead specimen taken from a nest in the rolled tip of palm-fronds from the thatching of a native hut. There were many such nests, but the season was over and I could not find the wasps.

The single specimen, a ♂, resembles *ignavum*, Turner; but, in addition to the different nesting-habits, may be distinguished by the presence of a shining furrow between the scutellum and the post-scutellum; also by the greater width of the interocular space on the vertex.

Tahiti, sea-level, August 1925 (*L. E. C.*).

11. *Oxybelus uturoa*, sp. n.

Black; apical abdominal segments and apical margins of first and second tergites, tibiae, and tarsi red-brown; fasciæ on first and second tergites lemon-yellow.

♀. Face rather coarsely and densely punctate, the space between the punctures shining; covered thinly with longish, silver, appressed pubescence. Disc of clypeus very densely and finely punctate, sharply raised with a distinct shining median tubercle; apical margin produced, shining, with a few fine punctures; lateral angles with two small teeth. A short median sulcus just above the antennæ. Vertex transverse reticulate-punctate, with sub-erect pale brown hairs.

Pronotum very deeply impressed before the anterior margin, which is turned upwards in a thin vertical lamella, deeply emarginate. Mesonotum rather coarsely and very densely punctate, with short, red-brown, appressed hair; scutellum and post-scutellum coarsely and densely punctate, the hair longer and suberect; the mesonotum with a longitudinal carina, which persists on the scutellum and post-scutellum as a prominent keel. Scutellum roundly arched; squamæ widely separated at the base, curved at the apex, and directed backwards; mucro rather long, deeply channelled above and broad at the base (see fig. 4). Propodeon with an oval shining disc in the centre of the posterior face, from the lower end of which a short carina reaches to the basal articulation, the upper end of the carina continuing on either side of the disc to the upper margin. Sides distinctly defined by sharply produced carinæ, with coarse regular striation, transverse near the base.

Abdomen covered with a thin, short, pale brown pilosity, the dorsal surface irregularly and finely punctate. First tergite with punctures less dense apically, the space between the punctures shining; the lateral yellow fasciæ wider in the centre, rounded above with the basal ends tapering; second tergite with the puncturation finer, very fine and dense at the base; the yellow fasciæ almost united, long and narrow, slightly wider in the centre.

Sternites with discs strongly produced, those of the first and second shining, black, minutely punctured, in the remainder tending to red-brown anteriorly, the basal half punctured; apical margins of all the sternites, except the two basal, red-brown.

Legs with apical tarsal segment broadened. Wings hyaline. Long. $6\frac{1}{2}$ mm.

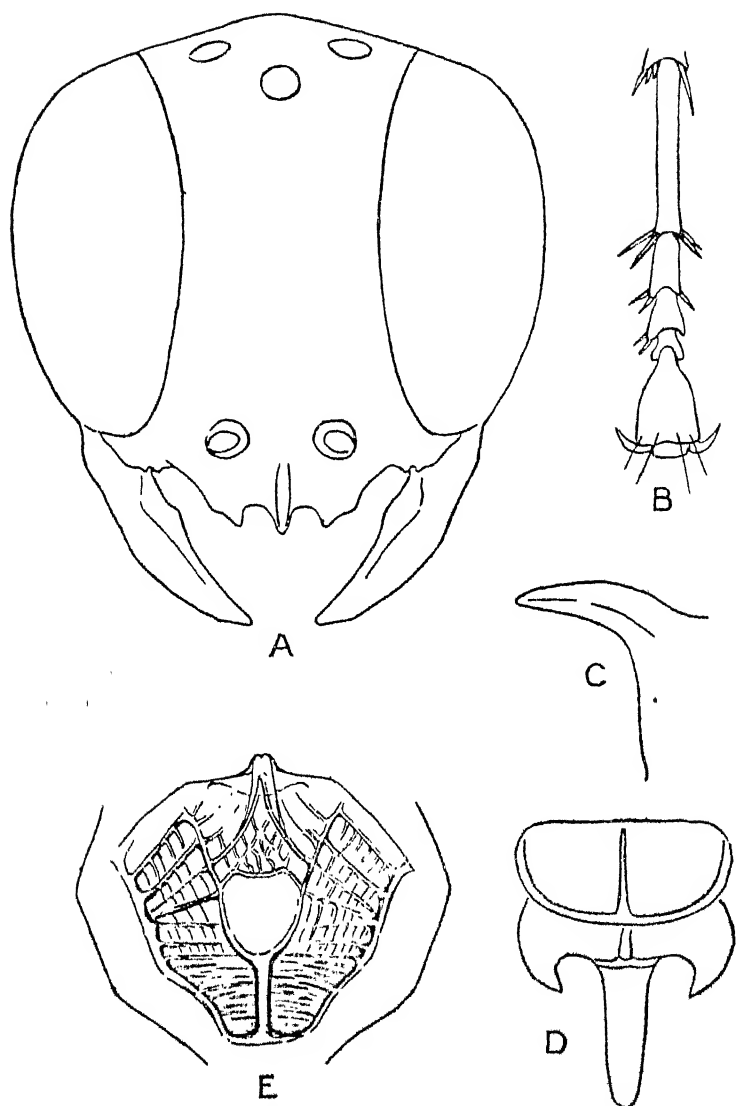
♂ as in the ♀. Clypeus densely covered with long silver hair except on the median keel. Abdominal lateral spines short, curved, and blunt. Long. 6 mm.

The yellow markings are variable, in some specimens (of both sexes) the pronotal collar and tubercles are yellow, or a small yellow plate is present at the base of the anterior femora on the outer side; in other specimens this is also present on the intermediate and posterior femora.

Resembles *O. emarginatus*, Say (N. America), but differs in form of the propodeon and surface-sculpture.

Society Is.: Raiatea, 18 ♂♂, 3 ♀♀. Both sexes taken feeding upon Coccid excretion on leaves, May 1925; Bora Bora, 5 ♂♂, flying on the coast-road, June 1925 (L. E. C.).

Fig 4.



Oxybelus uturoæ, sp. n.

A. ♂ head.

B. ♀ posterior tarsi.

C & D. Mucro.

E. ♀ propodeon.

VESPOIDEA.

Vespidæ.

12. *Eumenes pomiformis*, Sauss. Et. Vesp. p. 28 (1852).

Society Is.: Tahiti, 4 ♀ ♀, March; 1 ♂, 1 ♀, April 1925 (*L. E. C.*).

Taken in one locality only, on the coast-hills above Papeete at about 1000 ft. Females were making burrows in March in the very dry clay soil on the trail; attempts to dig out two nests were unsuccessful owing to the hardness of the ground.

Distribution. Spain, Italy, Crete, Persia, India, Peshawur, Tientsin, Syria, Egypt, Java.

13. *Polistes macaensis*, F., Ent. Syst. ii. p. 259 (1793) (Macao).

Tuamotu Arch.: Fakarava, 1 ♀. Marquesas Is.: Hiva-oa, 5 ♀ ♀; Tahuata, 3 ♀ ♀, Jan. 1925 (*St. George Exp.*).

14. *tahitensis*, subsp. n.

A dark variety of *macaensis*; the markings black instead of fuscous, and the ground never yellow, even in the newly-emerged females, but of a distinctly tawny shade; in the majority of specimens taken the antennæ are also darker in *tahitensis*, but in specimens from Bora Bora the colour of the antennæ is identical with that of the typical form.

Extremely numerous on these islands, where they form large colonies in the hottest and driest areas on the shore-belt and the coast-hills where the scrub is periodically burnt over; they are not found in the dense moist scrub of the interior regions. On the largest nest which I saw, where the brood, both sexes, were just emerging (March), they numbered with the old workers and queens 150-160. The pairing takes place soon after emergence. The females fly in numbers to some shaded place, such as the interior of buildings, where they gather in the roof or in dark corners. They sometimes assemble in hollow tree-trunks. The males follow them, searching for them and dragging them out from the corners and crevices. Copulation takes place instantly, usually in the air, but often both will fall heavily to the ground, and the female may receive some hard knocks before being released. At such times the wasps are a very serious inconvenience to the inmates of houses, although they do not sting except in self-defence. This wasp is of a

quiet inoffensive nature. The workers will attack any intruder near the nest, but are not vindictive; and, as they appear to feed their larvæ only upon insects, they are not in competition with mankind over food, and seldom enter houses except to pair or to hibernate. But their great numbers and their habit of building nests in scrub and grass a foot or two from the ground make them a nuisance in inhabited and cultivated areas. The wound from a sting is extremely painful for a few minutes, but no reaction is felt for any length of time after, except in the case of many stings, especially on the head and face, when swelling and inflammation may result.

The French cultivators of these islands affirm that the variety of these wasps on the Society Islands changed their nesting-habits owing to the mynah bird which was introduced in order to exterminate them; that they formerly nested openly in high trees; and that, because their colonies were more easily attacked in such situations, they evolved the habit of concealing the nest in low scrub. My observations tend to confirm the difference in the situation chosen for the nest. Upon the islands of the Marquesas nests were very numerous, but without exception in very high situations usually under the fronds of full-grown coconut-palms; while, on the other hand, I only once found a nest on Tahiti in a high position. I never upon any occasion saw a mynah attack a wasp.

Tuamotu Arch.: Napuka, 1 ♂. Society Is.: Tahiti, 4 ♀ ♀, 6. iii. 25; Bora Bora, 11 ♂ ♂, 1 ♀, 11. vi. 25 (*L. E. C.*).

15. *Polistes aurifer*, Sauss. *Et. Vesp.* ii. p. 78 (1853) (California).

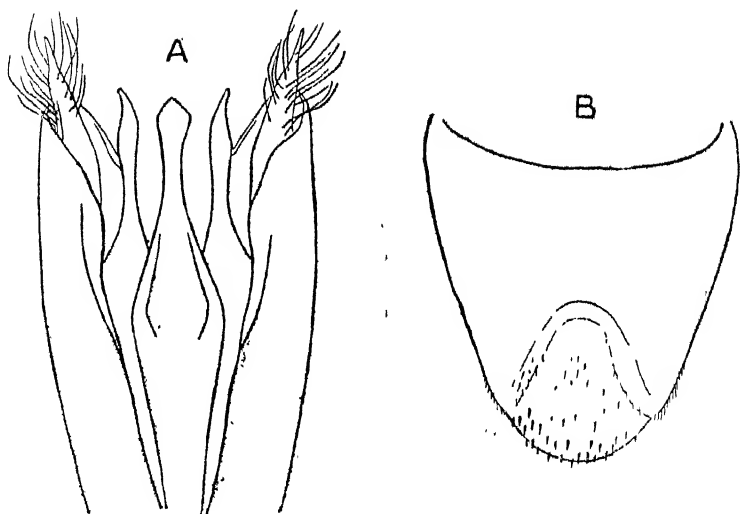
Society Is.: Tahiti, 6 ♀ ♀, March; Raiatea, 1 ♂, 5 ♀ ♀, May; Bora Bora, 1 ♂, 5 ♀ ♀, June 1925 (*L. E. C.*).

16. *Polistes bernardi*, Le Guillon, *Ann. Soc. Ent. France*, x. p. 321 (1841) (Australia septentrional).

Society Is.: Tahiti, Papenoo Valley, 5 ♂ ♂, 1 ♀, 1 ♂, 6. iii. 25 (*L. E. C.*). (Fig. 5.)

I have not seen the type of this species. Specimens vary in coloration, the yellow markings of the posterior face of the propodeon being present or absent in specimens from Mackay in the B.M. coll. In all the specimens taken on Tahiti the yellow markings are present.

Fig. 5.



Polistes bernardi, Le Guillon.

A. ♂ genitalia. B. ♂ sixth tergite.

17. *Odynerus (Rhynchium) rufipes*, F., Syst. Ent. p. 367 (1775).

Marquesas Is.: Fatu-hiva, 2 ♂♂, 6 ♀♀; Nuku-hiva, 2 ♀♀; Hiva-oa, 1 ♀, Jan. 1925 (*St. George Exp.*). Society Is.: Tahiti, 1 ♂, 7 ♀♀, March-June 1925; Raiatea, 1 ♀, 2. vi. 27 (*L. E. C.*).

Burrows in posts or in living trees, the bottom lined with fine sand and the burrow closed with the same mixed with saliva into a mortar. Bred from the mud-cells of *Sceliphron* on the Marquesas; two dead specimens taken from a nest in the rolled tips of palm-fronds used in thatching.

Distribution.—Leo-choo, Samoa, Fiji, Rarotonga, Australia.

18. *Odynerus (Rhynchium) hamorrhoidale*, var. *brunneum*, F., Syst. Ent. p. 366 (1775).

Rhynchium tahitense, Sauss. Reise Novara, Zool. ii. p. 7 (1867) (Tahiti).

Marquesas Is.: Hiva-oa, 3 ♂♂, 3 ♀♀; Nuku-hiva, 1 ♂, 2 ♀♀; Fatu-hiva, 2 ♀♀; Tahuata, 2 ♀♀, Jan. 1925 (*St. George Exp.*). Society Is.: Tahiti, 1 ♂, 1 ♀, 8. iii. 25; Raiatea, 1 ♀, 26. v. 25 (*L. E. C.*).

Seen collecting mud on the Marquesas Is. and entering a hole in a post. Bred out of a cluster of cells of *Sceliphron*.

Distribution. China, India, Java.

19. *Odynerus bicinctus*, F., Spec. Ins. i. p. 465 (1781).

Tuamotu Arch.: 5 ♂♂, 3 ♀♀, Jan. 1925. Marquesas Is.: Hiva-oa, 1 ♂, 6 ♀♀; Fatu-hiva, 2 ♀♀, Jan. 1925 (*St. George Exp.*). Society Is.: Tahiti, 2 ♂♂, 5 ♀♀; Raiatea, 3 ♂♂, 1 ♀, 12. vi. 25: Bora Bora, 1 ♂, 3 ♀♀, June 1925 (*L. E. C.*).

Extremely numerous on all the islands. Burrows in wood, sometimes in the holes bored by *O. rufipes*.

HYMENOPTERA (PARASITICA).

EVANIIDÆ.

1. *Evania sericea*, Cam.
2. *Evania appendigaster*, L.

BRACONIDÆ.

3. *Apanteles* sp.
4. *Apanteles* sp.
5. *Apanteles* sp.
6. *Apanteles* sp.
7. *Microbracon hebetor*, Say.
8. *Monolexis brugirouvi*, sp. n.
9. *Microdus tautiræ*, sp. n.
10. *Zelex filicornis*, Cam.

ICHNEUMONIDÆ.

11. *Barichneumon veo*, sp. n.
12. *Echthromorpha agrestoria*, Swed.
13. *Echthromorpha atrata*, Holmgr., *marquisensis*, subsp. n.
14. *Echthromorpha walkeri*, Cam.
15. *Vakau taitensis*, gen. & sp. n.
16. *Zimmerium christiana*, sp. n.
17. *Henicospilus nocturnus*, Kohl.
18. *Henicospilus samoana*, Kohl.
19. *Fremotylus mora*, sp. n.
20. *Diplazon letatorius*, F.

Evaniidæ.

1. *Evania sericea*, Cam. Trans. Ent. Soc. p. 191 (1883) (Hawaii).

Evania impressa, Schlatt. Ann. Naturh. Hofmus. Wien, iv. p. 153 (1889) (New Hebrides, Fiji).

Marquesas Is.: Nuku-hiva, 2 ♀♀; Hiva-oa, 2 ♂♂, 1 ♀; Fatu-hiva, 5 ♂♂; Tahuata, 2 ♂♂, Jan. 1925 (*St. George*

Exp.). Society Is.: Tahiti, 10 ♂♂; Raiatea, 2 ♂♂, 3 ♀♀; Bora Bora, 1 ♂, 2 ♀♀, March–Aug. 1925 (*L. E. C.*).

Taken from the coast to 3000 feet on Tahiti. One aberrant ♀ from Raiatea in which the length of the petiole is about one-half of that in normal specimens.

In 1916 Brues (*Bull. Amer. Mus.* xxxv. p. 717) described a new species of *Evania* from Murea, Society Is., which he named *carinata*; but this is probably a synonym of *sericea*, Cam. I have not seen the type, but the description agrees with *sericea*, and Brues was apparently unfamiliar with this species, as he makes no reference to it in this paper.

Distribution. Pacific Is.

2. *Evania appendigaster*, L., *Syst. Nat.* (ed. x.) i. p. 566 (1758).

Evania curvinervis, Cam. *Proc. Trans. N. H. Soc. Glasgow*, ii. 1887, p. 265 (Tahiti).

Marquesas Is.: Nuka-hiva, 1 ♂; Fatu-hiva, 2 ♂♂, 1 ♀, Jan. 1925 (*St. George Exp.*). Society Is.: Tahiti, 2 ♂♂, 15. iv. 25 (*L. E. C.*).

Cosmopolitan.

Braconidæ.

3. *Apanteles* sp.

Society Is.: Tahiti, Hitiaa, 10 ♀♀, 7, 9, 10. vii. 27.

4. *Apanteles* sp.

Marquesas Is.: Hiva-oo, 9 ♀♀ bred from pupæ, Jan. 1925 (*St. George Exp.*).

5. *Apanteles* sp.

Society Is.: Raiatea, 3. vi. 25, 2 ♀♀.

6. *Apanteles* sp.

Society Is.: Tahiti, Hitiaa, 2 ♀♀, 23. viii. 25.

These species of *Apanteles* are being worked out by Mr. D. S. Wilkinson, of the Bureau of Entomology.

7. *Microbracon hebetor*, Say.

Bracon hebetor, Say, *Boston Journ. Nat. Hist.* i. pt. 3, p. 252 (1836).

Eleven specimens emerged from coprah on board a transport steamer from New Caledonia and Tahiti to Marseilles.

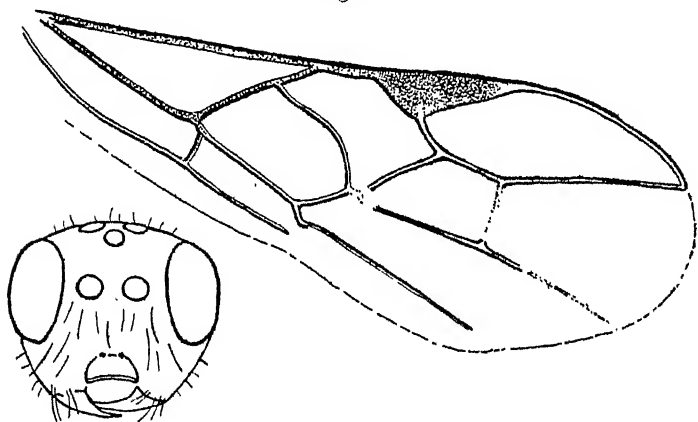
Cosmopolitan.

8. *Monolexis brugirouxi*, sp. n.

♀. Black, glabrous; strongly sculptured, with rather long, sparse, whitish hairs. Head, except the mandibles, reddish yellow. Abdominal segments, except first and second, very dark brown. Stemmaticum, lower part of the mesopleuræ, and apices of tarsi fuscous brown. Legs stramineous, translucent. Wings hyaline, stigma and nervures fuscous.

Frons very finely punctate with transverse aciculations and with a small, smooth, central disc between and below the antennæ. Clypeus distinctly separated, with two small foveæ near together at its base. Cheeks rather long, with faint remote aciculation. Mandibles slightly curved, long,

Fig. 6.

*Monolexis brugirouxi*, sp. n.

A. ♀ fore wing. B. ♀ head.

and slender (see fig. 6). Mesonotum with deep notauli, the central lobe with two parallel longitudinal impressions reaching the anterior margin, coarsely reticulate upon each side of the impressions; the lateral lobes with sparse fine punctures, separated from the scutellum by a transverse series of deep impressions, whose length is about a third of the scutellum. The scutellum subtriangular in form, with a few minute punctures; the sides of the scutellum with a broad basal carina, from which radiate a few short, irregular, longitudinal striæ. Post-scutellum with a basal carina, longest in the centre, and a few coarse short striæ at the sides. Propodeon distinctly areolated with well-produced

carinæ; the areola roughly diamond-shaped with transverse striæ; basal area rugulose, divided by a short median carina; the sides with irregular transverse striæ. Costulæ present. Propleuræ faintly rugulose, the furrow crenulate. Mesopleuræ impunctate below with a short transverse sulcus; the anterior angle with short transverse striæ, the posterior angle with a series of deep marginal impressions. Meta-pleuræ coarsely reticulate, separated from the mesopleuræ by a carina, from which very short striæ radiate on both sides.

Length of first abdominal segment slightly exceeding its width at the apex—longitudinally striate, with two carinæ originating from the sides of the basal articulation and terminating at about two-thirds of its length; the suture between the first and second segments deep and shining, widest in the centre. Length of the second segment twice that of the first, considerably wider at the apical margin than at the base; longitudinal striæ reaching from the base to almost half the length (to about three-quarters at the sides), rugose between the striæ, with an undulating transverse series of short longitudinal indentures at about the centre of the segment, curving forwards at the sides. Anterior femora rather short, width almost one-third of the length. Length of terebra about equal to the abdomen. Length, including terebra, 5.5 mm.

Society Is.: Raiatea, 1 ♀, 3. vi. 25.

Named in honour of M. Brugiroux, Directeur de la Station Agronomique at Tahiti.

9. *Microdus tautiræ*, sp. n.

♀. Reddish yellow, translucent, glabrous; sparsely covered with short, pale, yellow hairs. Eyes, apex of mandibles, and claws black; antennæ, posterior tarsi, and a broad fascia at the apex of the tibiæ, the apical segments of the intermediate and anterior tarsi, the fourth abdominal tergite, and terebra dark fuscous brown.

Head transverse; face twice as wide as long, with sparse minute punctures. Clypeus not separated from the frons, apical margin narrowly produced, the foveæ deep. Distance between the posterior ocelli about half of that between them and the eyes. Antennæ with 33 segments. Mesonotum with notauli distinct but not very deep, the lateral margins punctate. Scutellum rather flattened, rugulose. Prescutellar groove deep with short longitudinal striæ. Propodeon distinctly areolated, coarsely reticulate punctate. Propleuræ

with an oblique line of irregular punctures anteriorly. Mesopleuræ with a short, transverse, crenulate sulcus, and a few minute scattered punctures.

First abdominal tergite narrowed at the base, with fine longitudinal striation; the length one and a half times the breadth at the apex. Second tergite with two obscure transverse impressions. Length of the terebra 3 mm.

Wings infusate. Radial cell long and extremely narrow. Length 3 mm.

Society Is.: Tahiti, 4 ♀ ♀. Taken flying two miles inland in the Valley Vaitepiha, Tautira, Aug. 1925 (L. E. C.).

10. *Zele filicornis*, Cam. Journ. Straits Asiatic Soc. xxxix. p. 128 (1903) (Borneo).

Marquesas Is.: Nuku-hiva, 2 ♀ ♀, Jan. 1925 (*St. George Exp.*). Society Is.: Tahiti, Hitiaa, Mataea Valley, 1 ♂, 9.vii.25; Bora Bora, 2 ♀ ♀, taken at night, sea-level, 10.vi.25 (L. E. C.).

Distribution. Borneo, Singapore, Samoa, Society Is., Marquesas Is.

Ichneumonidæ.

11. *Barichneumon veo*, sp. n.

Black; head and thorax shining, with dense, coarse, irregular puncturation and short sparse hairs, whitish on head and pale brown on the thorax. Abdomen opaque with dense fine punctures and a thin covering of very short dark pilosity. Tubercle at the base of the mandibles reddish. Male with inner orbital fasciæ and clypeal foveæ light yellow.

♀. Head transverse; frons flattened, slightly buccate in the centre, and tuberculately produced between the antennæ. A few coarse punctures below the antennæ, also forming a transverse line on the clypeus. Foveæ deep. Clypeus not separated from the frons, truncate apically, before the narrowly produced apical margin. Mandibles shining, with a small inferior tooth. Length of the antennal scape once and one-third its width; first and second segments of the flagellum subequal, third segment slightly shorter. Head behind the ocelli sloping sharply at an angle. Distance between the posterior ocelli rather less than that between them and the eyes. Mesonotum slightly longer than broad. Scutellum slightly buccate, coarsely longitudinally reticulate-striate. Propodeon areolated with distinct carinæ; basal

area shining, short, and narrow; the sides coarsely reticulate-punctate, more densely basally. Costulae absent. Spiracles elongate.

Propleuræ longitudinally striate-punctate. Mesopleuræ with reticulate puncturation coarser below and on the meta-pleuræ. Petiole bottle-shaped, width at the base two-thirds of its length, with dense, fine, longitudinal striation and a few coarse punctures. Gastroceci shallow, glabrous, with short striæ radiating anteriorly. Second abdominal segment broader at the apex than at the base. Second and third segments with very dense shallow puncturation, which is more shallow and finer on the remaining segments. Posterior coxæ smooth, the width two-thirds of the length; posterior claws normal. Wings slightly infusate. Areolet irregularly pentagonal.

Length 11.5 mm.

♂ with the inner side of the posterior tarsal segments armed with short rather slender spines.

Marquesas Is.: Hiva-oa, 3 ♂♂, Fatu-hiva, 1 ♀, Jan. 1925 (*St. George Exp.*).

12. *Echthromorpha agrestoria*, ~~Swed.~~

Ichneumon agrestorius, Swed. Svensk. Vet.-Akad. Handl. viii. p. 279, no. 32 (1787) (Tahiti).

Society Is.: 46 ♂♂, 4 ♀♀, March–April 1925; Raiatea, 13 ♂♂, 2 ♀♀, May 1925; Bora Bora, 5 ♂♂, June 1925 (*L. E. C.*).

Very numerous on all three islands from the coast to 3000 ft.

13. *Echthromorpha atrata*, Holmgr., *marquisensis*, subsp. n.

♀. Black; orbital margin behind and above the eye reaching to the base of the antennæ dull yellow, a narrow fascia on the margin of the eye itself on the vertex yellowish white. Frons, clypeus anteriorly except the apical margin, base of the mandibles, labium, except a narrow apical margin, dark brown. Tegulae and humeral tubercle brown. Prosternum and propleuræ suffused with brown. Abdominal tergites suffused with fuscous-brown at the apices and apical segments of terebra fuscous-brown. The anterior pair of legs with the coxæ yellowish in front and brown behind; femora and tibiae yellowish brown suffused with fuscous-brown. Intermediate pair of legs with the coxæ, trochanters, and femora fuscous-brown. Posterior

pair of legs with the femora and inner side of coxæ and trochanters fuscous-brown.

Agrees structurally with *atrata*, Holmgr., which is only recorded from St. Helena, but differs in the coloration.

Marquesas Is.: Fatu-hiva, 3 ♀ ♀, Jan. 1925 (*St. George Exp.*).

14. *Echthromorpha walkeri*, Cam. Proc. N. H. Soc. Glasgow, p. 265 (1887), ♂ (Tahiti).

Marquesas Is.: Hiva-oa, 3 ♂ ♂; Tahuata, 3 ♂ ♂; Fatu-hiva, 3 ♂ ♂, 1 ♀, Jan. 1925 (*St. George Exp.*). Society Is.: Tahiti, 1 ♀, taken flying on the hills above Papeete at about 2500 ft., 5.v. 25; Lake Vaihiria, 1 ♀, 19.vii. 25; Bora Bora, 1 ♂, 10.vi. 25 (*L. E. C.*).

Distribution. Society Is., Marquesas Is.,

VAKAU, gen. nov.

Head transverse, length five-sevenths of its breadth, with a distinct space between the margin of the eyes and the base of the mandibles. Clypeus not separated from the frons at the base, sloping outwards anteriorly at an angle (see fig. 7, B). Antennæ long and slender, almost reaching the end of the abdomen; terminal segment conical, as long as the two preceding together. Mesothorax without notauli. Metathorax distinctly areolated, with longitudinal carinæ; spiracles very small, oval. Abdomen spindle-shaped; the petiole long and slender, becoming broader anteriorly and narrowed again at the apex. Spiracles considerably after the middle, second abdominal segment equals the petiole in length; second, third, and fourth segments slightly flattened dorsally. Terebra less than one-third the length of the abdomen. Legs slender, the femora long. Claws small, simple. Wings hyaline, as long as the body. Areolet pentagonal, with the outer nervure wanting and the inner nervure very short; first recurrent nervure not interstitial. Nervellus unbroken, post-furcal. Radial cell large, but not reaching the apex of the wing; apical abscissa twice the length of the basal abscissa (see fig. 7, A).

Type. *Vakau taitensis*.

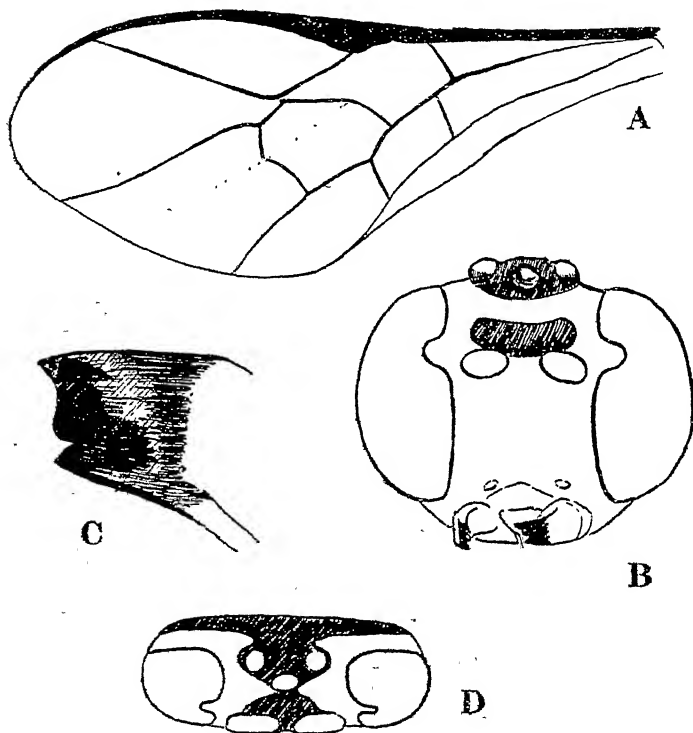
15. *Vakau taitensis*, sp. n.

Matt; minutely granulate, with fine shallow puncturation and a sparse covering of pale yellow hairs.

♀. Yellow; with stemmaticum, fascia behind the antennæ, apex of mandibles, underside of the head, three longitudinal

fasciæ on the mesonotum, the central extending to the pronotum and ending in a transverse infuscation reaching to the apex of the propleuræ, the two lateral extending over two-thirds of the length not touching the sides of the mesonotum, lateral inner margin of the metapleuræ, basal area of the propodeon, fasciæ at the base of the posterior coxæ

Fig. 7.

*Vakau taitensis*, sp. n.

A. ♀ fore wing.

C. ♀ mandible.

B. ♀ head.

D. ♂ head.

and trochanters, also on the tibiæ, continuing from the base halfway up the inner side, apical segments of the posterior tarsus and apices of the remaining segments, all the abdominal tergites (including the petiole) with the exclusion of their apical margins dark purplish brown.

Head, including eyes, wider than long ($7\frac{1}{2} : 9$). Frons

slightly convex. Eyes narrowly emarginate, the interocular space scarcely wider at the clypeus than on the vertex. Clypeus slightly convex and bent outwardly and upwards at right angles to the frons, the apical margin narrowly produced. Mandibles broad, vertical, curving outwards, and folded beyond the clypeal margin; bidentate, the upper tooth very broad and bluntly rounded below (see fig. 7, C).

Mesonotum hexagonal, the width equal to the length, with a longitudinal striate puncturation. Scutellum buccate, separated from the mesonotum by a deep suture. Metathorax areolated with delicate but distinct longitudinal carinæ, the areola open below; the basal area narrow, divided by a short longitudinal carina. Costulæ present. Propleuræ aciculate, the ventral apex with transverse striæ. Mesopleuræ with an oblique furrow, and separated from the metapleuræ by carinæ. Coxæ short and rather broad; posterior femora incrassate, the width about one-fourth the length. Calcar of the intermediate tibiæ with the inner spine pectinate, three times the length of the outer spine. Abdomen cylindrical, long, and slender; length of the first two segments together almost equals the remaining segments. The first segment (petiole) equal in length to the second, slender, subglabrous, with faint aciculations, slightly broadened at four-fifths of its length, and narrowed again at the apex; spiracles small, round, considerably nearer the apex than the base; second segment twice as wide at the apex as at the base; third segment slightly wider at the apex than at the base.

Length $5\frac{1}{2}$ mm.

♂ as in the ♀, but with the clypeal apical margin not produced. Coloration differs, there being larger areas of the black markings; the two lateral fasciæ of the mesonotum extending to the lateral margins; the upper part of the mesopleuræ and greater part of the metapleuræ, with the exception of the humeral tubercle black, also longitudinal fasciæ on the posterior femora and all segments of the posterior tarsi.

Society Is.: Tahiti, 1 ♂, taken flying on the coast-hills at Papenoo at 1500 ft., 8.iii.25; Vaitepiha Valley, 1 ♂, 7.viii.25; Raiatea, 1 ♀, on the hills above Uturoa at 1500 ft., 29.v.25.

I have the honour of naming this species after Princess Vakau Pomare of Tahiti.

16. *Limnerium christianæ*, sp. n.

Dull black, densely and finely punctate, with a thin

covering of longish silver hairs on the head, thorax, and posterior coxæ. Legs with a pale brown pubescence. The scape below, palpi, mandibles, except the apex, tegulæ, and radix of wings; anterior and intermediate pairs of legs, and trochanters of the posterior pair stramineous; posterior pair of legs with the exception of the trochanters fuscous-brown; terebra fuscous-brown. The discs of the second and third abdominal tergites suffused with fuscous-brown, terminal abdominal segments dark yellowish brown, with a few irregular fuscous suffusions.

Head rugose, the width equal to the length. The inter-orbital space only slightly wider at the vertex than at the clypeus; clypeus rounded at the apical margin; mandibles subdeclivous with a few fine punctures, bidentate, the teeth shining, black, equal in size. Antennæ imperfect, number of segments 21, but the apical segments missing. Eyes not emarginate. A short longitudinal stria between the posterior ocelli, the space between the pair almost twice that between them and the eyes. Mesonotum with fine, dense, irregular puncturation on an aciculate ground. Scutellum buccate, almost circular, punctures finer than on the mesonotum. Propodeon distinctly areolated, the basal area small; areola not closed below; sides very densely punctate, costulæ present; spiracles small, circular.

Propleuræ subglabrous, with irregular transverse striæ, the upper angles finely punctate. Mesopleuræ with fine dense puncturation, a central shining area, and a few irregular transverse striæ immediately below the tegulæ, separated from the metapleuræ with a shining carina, with very short transverse carinæ on the inner side. Petiole shining at the base, narrow for two-thirds its length, gradually broadened and bulbous at the apex, the width at the apex less than one-third the length; the bulbous area aciculate. Spiracles small, circular well behind the middle. The remaining abdominal segments dull, minutely granulate. Length of the second segment just over three-fourths of the petiole. Terebra half as long as the abdomen. Wings hyaline. Second recurrent nervure emitted slightly before the middle of the areolet. Nervellus not oblique and unbroken. Areolet petiolate, irregularly quadrate.

Length 8 mm.

Society Is.: Raiatea, 1 ♀, 7.ii.25. Taken flying on a ridge inland at 1500 ft. (*L. E. C.*).

Named after Miss Elsie Christian of Vairumai.

17. *Henicospilus nocturnus*, Kohl, Denkschr. Akad. Wiss. lxxxi. p. 315 (1908).

Society Is.: Tahiti, 1 ♀, taken at 1000 ft., 15. iv. 25 ; Raiatea, 1 ♀, sea-level, 26. v. 25 (L. E. C.).

18. *Henicospilus samoana*, Kohl, loc. cit. p. 315.

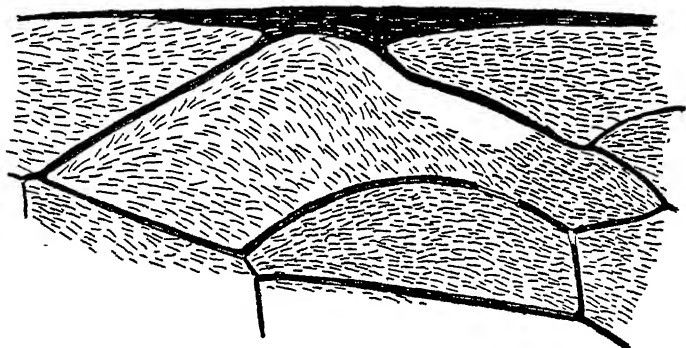
Soc. Is.: Tahiti, 1 ♀ in the Mataea Valley, Hitiaa. 9. vii. 25 (L. E. C.).

Distribution. Samoa, Tahiti.

19. *Eremotylus moea*, sp. n.

♀. Dull black, covered with longish, shining, brown hairs, which are shorter on the mesonotum ; palpi, tibiae, and tarsi fulvous-brown, with a lighter brown pubescence.

Fig. 8.



Eremotylus moea, sp. n.

Fore wing.

Frons not buccate, very finely irregularly punctate, with a small median tubercle a little below the base of the antennæ, from which a longitudinal carina reaches to the ocelli. Interocular space at the base of the clypeus three-fourths of that on the vertex. Clypeus roundly elevated, indistinctly separated from the frons at the base, narrowly truncate apically, the apical margin produced, depressed, with its length two-fifths of that of the clypeus. Mandibles shining, horizontal; bidentate, the upper tooth slightly longer. Antennæ with 55 segments. Mesonotum with fine shallow puncturation. Scutellum saddle-shaped, basally carinate

with strong parapsides. Propodeon exareolated, rugose; basal area with distinct transverse carina, and minutely punctured. Mesopleuræ with fine, indistinct, transverse striæ and dense irregular puncturation. First and second abdominal segments subequal in length; the petiole (first abdominal segment) long and slender, its greatest breadth less than one-fifth of its length. Posterior coxæ with fine puncturation. Claws long, the apices longer than the teeth of the pecten. Wings slightly infusate. Radius of fore wing slightly unisinuuous basally (see fig. 8). Discoidal cell not basally acuminate, the pellucid area two-thirds of the length of the basal abscissa of the radius. Discoidal nervure curved, not geniculate, with fenestra after the middle. Upper basal nervure straight. Nervulus antefuscal, with fenestra at the base. Nervellus interstitial, broken below the middle.

Marquesas Is.: Hiva-oa, 1 ♀, taken flying at Moea, Jan. 1925 (*St. George Exp.*).

20. *Diplazon letatorius*, F.

Ichneumon letatorius, F., Spec. Ins. 1. p. 424, no. 26 (1781).

Marquesas Is.: Fatu-hiva, Hiva-oa, 2 ♀ ♀, Jan. 1925 (*St. George Exp.*). Society Is.: Tahiti, 1 ♀, 16. iii. 25 (*L. E. C.*).

Distribution. Europe, Victoria, Hawaii, U.S.A., Chile.

Recorded as parasitic on the larvæ of *Syrphus pinastri*.

XV.—*New Sipunculoidea from California.*

By W. K. FISHER, Hopkins Marine Station, California.

[Plates VI.-VIII.]

DENDROSTOMA is generally regarded as characteristic of warm seas. It is a matter of interest, therefore, to find two large species in the relatively cold water of the California coast. *D. petræum* hides in fissures of rocks, between tide-levels, on a coast almost constantly lashed by surf, where the temperature of the ocean ranges from 49° to 57° Fahrenheit. *D. perimeces* lives among eel-grass (*Zostera*) in the sandy mud of an estuary, where the temperature is a few degrees higher than that of the neighbouring ocean. The creature, which is very long and slender, is found

usually in an upright position with the expanded tentacles just above the surface. It feeds on minute particles of detritus and such of the microflora and fauna as fall into its elaborate dendritic trap. The neutral olive or greyish brown of the tentacles is nearly the colour of the mud. This species has been kept for over a year in the laboratory.

Dendrostoma petraeum, sp. n. (Pl. VI. figs. 1, 1 *a*, 1 *b*, 2 ;
Pl. VII. fig. 2 ; Pl. VIII. figs 1, 1 *a*.)

Size large ; length upward of 120 mm., exclusive of tentacles ; body elongate pear-shaped, the greatest width at about posterior third ; in specimens carefully killed, with introvert extended, the greatest width equals about one-fifth to one-sixth the total length (occasionally slenderer). Introvert cylindrical ; anterior third a reddish brown, glossy collar marked by fine circular creases ; at posterior border of this collar is a strong sphincter, sometimes indicated by a constriction and a narrow purplish zone in alcoholic specimens. Immediately behind this, the middle third of introvert (8-12 mm. broad) is occupied by dark brown, well-spaced prominent hooks, directed posteriorly, their bases varying from 0.19 to 0.25 mm. in diameter (Pl. VI. figs. 1 *a*, 1 *b*). Basal third of introvert smooth, not divided into rectangular blocks as in *alutaceum*. Surface of trunk superficially smooth (not marked by transverse furrows), very finely and evenly peppered with minute brown spots of two or three sizes, which in some specimens, at least, are tiny eminences. These extend forward as far as the anterior border of the zone of hooks, but on the introvert are usually colourless.

Tentacles highly dendritic. Four food-grooves lead outward from the mouth to as many groups of tentacles ; each group consists of usually two main stems, between which a shorter branch sometimes assumes the proportions of a major division. The grooves follow the branches to the smallest finger-like divisions. The tentacles do not give off secondary dendritic branches near the base as in *perimeces*. Instead, the thin mobile margin of the groove, below the main branches, is produced at intervals into a few slender processes (Pl. VII. fig. 2).

Colour in life : ground-colour pale buffy, suffused with pale sepia, or warm sepia, some examples dark at posterior end ; collar pale Hays maroon, madder-brown, or liver-brown (Ridgway, plates 13 & 14). Main stem of tentacles

same, branchlets and tips pale yellow, sometimes mottled with madder- or liver-brown. In alcohol paler, the sphincter (anterior to zone of hooks) becoming bluish or purplish.

The longitudinal muscles of body-wall form a continuous layer; circular muscles also form a continuous layer; coelomic surface of body-wall with a satiny lustre.

The two large ventral retractors have their origins in wide straight attachments at middle of posterior third of body, the inner border of the muscle arising close to the nerve-cord. The pair of nephridia are very long and are attached to body-wall slightly behind the anus. They may reach the posterior end of body. A spindle muscle is inserted in the body-wall immediately behind the anus; muscle-strands, from oesophagus and intestine (as shown in Pl. VI. fig. 1), reach body-wall at a considerable distance anterior to origin of retractor muscles. A horizontal mesentery attaches the oesophagus to inner surface of anterior part of retractor muscles. The posterior border of this mesentery is anterior to the profusely branching end of the Polian canal.

The Polian canal (Pl. VIII. fig. 1 *a*) passes along the dorsal surface of the oesophagus and gives off lateroventrally numerous anastomosing branches, which form a network enclosing the oesophagus and becoming more complex posteriorly. For a short distance at the posterior end of this net numerous long, blind, often spiral, tubules are given off from the main dorsal canal and also from the network of vessels. Some of these branch several times near the base. They form a complex tangle around the intestinal coil, nephridia, and retractors.

The cerebral ganglion as seen from above is broadly elliptical in contour. In one specimen an eye-spot can be seen on either side of the cerebral mass.

Type.—Will be deposited in U.S. National Museum; paratype will be deposited in the British Museum (Natural History).

Type-locality.—Point Pinos, Monterey Bay, California, between tides, in clefts of granite rocks.

Dendrostoma perimeces, sp. n.

(Pl. VI. figs. 3, 3 *a*; Pl. VII. fig. 1; Pl. VIII. figs. 2, 2 *a*.)

Size large; length upward of 260 mm.; body very slender, cylindrical, tapering very gradually from the rounded or bluntly-pointed posterior end toward the anterior; greatest width of fully extended specimens one-

twelfth to one-twenty-fifth total length, usually nearer one-twentieth. Introvert cylindrical, its length about one-sixth to one-seventh total length; anterior fifth of introvert a glossy brown collar, marked by fine circular creases. This collar is followed by a smooth whitish zone not quite so broad (region of sphincter). Back of this the skin is pale sepia and thickly peppered with tiny dark brown papillæ provided with a terminal pore (Pl. VI. fig. 3*a*). On the introvert these papillæ are longer than thick, but on the trunk are replaced by minute, low, brown protuberances which give the skin a faintly rough feeling. There are no hooks anywhere on the body.

Tentacles six (Pl. VII. fig. 1), highly dendritic, branching down to the base, whereas in *petraeum* the main tentacles do not have small branches near the base.

Colour in life light dull sepia (pale greyish brown), darkest on introvert; anterior collar of introvert brown, sometimes slightly ruddy; tentacles pale olive-green or brown, sometimes whitish on sides opposite grooves.

The longitudinal muscles of the body-wall form a continuous layer, but at rather wide intervals very thin, narrow, oblique bands of muscle are present between the longitudinal and circular layers (Pl. VIII. fig. 2, *D*). Circular muscles also form a continuous layer; coelomic surface of body-wall with a satiny lustre.

The two large retractors are very long and have their origin at beginning of posterior fifth of body; line of attachment concave, the mesial end close to nerve-cord. The pair of nephridia are long, and are attached to the body-wall slightly behind the anus. A spindle muscle is inserted in the body-wall immediately behind the anus and to this (as well as to one another) are bound with short strands the many loops of the intestine. The oesophagus is slender and the anterior portion, as in *petraeum*, is held by a horizontal mesentery between the retractor muscles. The coil of the intestine is very long, reaching well toward end of body.

The Polian canal passes along the dorsal surface of the oesophagus and gives off, on either side, a collateral small vessel which forms a series of loops, and only at the posterior end embraces the oesophagus with a few meshes (Pl. VIII. fig. 2*a*). From either side of the posterior end of the Polian canal a few (six to eight in all) very long blind tubules are given off at short irregular intervals. These are evidently capable of being extended to end of body. They are

distinctly fewer in number than in *petræum*. The cerebral ganglion, as seen from above, is elliptical, with a deep notch on the anterior border. This notch is not evident in *petræum*. On either side of the brain is a tiny eye-spot.

Type.—Will be deposited in U.S. National Museum; paratype will be deposited in the British Museum (Natural History).

Type-locality.—Elkhorn Slough, Monterey Bay, California. In sandy mud, among *Zostera*.

EXPLANATION OF THE PLATES.

Reference letters.

- A. Anus.
- B. Cerebral ganglia.
- D. Oblique muscles of body-wall.
- G. Coil of intestine.
- I. Introvert; just above letter is position of nuchal sphincter.
- M. Horizontal mesentery of cesophagus.
- N. Nephridia.
- O. Cesophagus.
- P. Polian canal along dorsum of cesophagus.
- R. Retractors of introvert.
- S. Spindle muscle.
- T. Polian blind tubules.

PLATE VI.

- Fig. 1. *Dendrostoma petræum*; a large rather robust specimen from life, dorsolateral aspect, natural size. 1 a. Same; skin from introvert showing hooks, $\times 25$. 1 b. Same; a hook, $\times 50$.
- Fig. 2. *Dendrostoma petræum*; lateral view of preserved specimen, showing characteristic curvature of body, $\times 1$.
- Fig. 3. *Dendrostoma perimeces*; lateral view of preserved specimen, $\times \frac{3}{4}$. 3 a. Skin from introvert just anterior to anus, showing the brown papillæ, $\times 65$.

PLATE VII.

- Fig. 1. *Dendrostoma perimeces*; head of a specimen drawn from life, $\times 5$. This shows the food grooves leading to mouth, the smooth brown collar, the whitish sphincter zone, and behind this the anterior part of papillæ zone.
- Fig. 2. *Dendrostoma petræum*: view looking down upon the mouth, showing the base of the four groups of tentacles, the grooves leading to mouth, and the serrate border of grooves; alcoholic specimen, $\times 5$.

PLATE VIII.

- Fig. 1. *Dendrostoma petræum*; dissection, seen from above. The Polian canal is in solid black; nerve-cord in middle of ventral surface; at O three strands bind cesophagus to body-wall, and on opposite side a similar strand anchors the rectum (apparently absent from *perimeces*). Not all of the tubules from Polian

canal can be indicated. 1 a. Side view of œsophagus of *D. petraeum*, enlarged, to show network of vessels from Polian canal, *P.* At lower end of figure, the origin of the tubules of one side only is shown.

Fig. 2. *Dendrostoma perimeces*; dissection seen from above. The retractors are spread anteriorly to show the horizontal mesentery holding the œsophagus (*M*), while the Polian canal along dorsal surface of œsophagus is in solid black; for clearness, only four of the tubules are shown. The oblique dotted lines (such as *D*) indicate position of the delicate bands of muscle referred to in text. 2 a. Side view of œsophagus of *D. perimeces*, enlarged, to show simpler Polian canal system. The full number of tubules is shown.

Pacific Grove, California.

XVI.—*A new Echiuroid Worm from California.* By W. K. FISHER and G. E. MACGINITIE, Hopkins Marine Station, California.

[Plate IX.]

A LARGE echiuroid, resembling *Urechis chilensis* and having unusual habits and commensals, lives in the mud of inlets and bays along the coast of California. It has been taken from Monterey Bay (especially from tributary mud-bottomed estuaries) and from Moro Bay, San Luis Obispo county. Reports indicate that it is present in parts of San Francisco Bay.

The new species is rather plentiful in a slough, about twenty miles north of the city of Monterey, where the junior author has made numerous observations of mud-dwelling creatures. The behaviour of *Urechis* will be treated in a paper to follow.

The two other known species of *Urechis* have been described in detail: *Urechis unicinctus* (Drasche) of Japan, by Alice Embleton*, and *U. chilensis* (Müller), by Philipp Seitz†. *Urechis caupo*‡ is evidently more closely related to *chilensis* than to *unicinctus*. It differs from the latter in having three (instead of two) pairs of segmental organs and a thin-walled hind gut. Embleton states that the hind gut (rectum) is a "straight, wide, thick-walled tube." *Urechis* is an isolated genus, probably very ancient, and obviously not closely

* Trans. Linn. Soc. Lond. (2) vol. viii. pt. 3, pp. 77-97, pls. vii.-x.

† Zoolog. Jahrbucher, Abth. Anat. vol. xxiv. pp. 323-356, pls. xxix.-xxxi. (1907).

‡ Caupo, an inn-keeper, from the variety of commensals inhabiting the tunnels in which *Urechis* lives.

related to *Echiurus*. The systematic position of the new species may be indicated as follows:—

Family Urechidæ*, nov.

Differing from the Echiuridæ in lacking entirely a system of blood-vessels, the red blood-corpuscles, instead, floating in the cœlomic fluid; respiration by means of the hind gut and a muscular cloaca.

Genus URECHIS, Seitz.

Echiurus, authors.

Urechis, Seitz, Zool. Jahrb. Abth. Anat. vol. xxiv. p. 352 (1907).

Type, *Echiurus chilensis*, Müller.

Cylindrical, or sausage-shaped, echiuroids with a muscular, rugose, body-wall; proboscis not deciduous, short, resembling a scoop-shaped upper lip; inner layer of body-muscles in circular fascicles; the two anterior setæ close behind the mouth; one ring of anal bristles, interrupted ventrally; a zone of compound girdle-glands in the region of the posterior segmental organs; two or three pairs of segmental organs, functioning as receptacles of mature germ-cells, each provided with two long spiral extensions of the lips of the cœlomic aperture; alimentary canal long, convoluted, a spacious hind gut functioning as a respiratory organ in connection with a muscular holothurian-like cloaca; two anal or nephridial vesicles (their surface provided with numerous ciliated funnels on short stems) opening into ventral part of cloaca.

Urechis caupo, sp. n.

Diagnosis.—Differing from *U. chilensis* (Müller) in the following particulars: anterior bristles with tapered pointed tip; lining of mouth-cavity and pharynx thrown into continuous, prominent, longitudinal folds which do not become zigzag, but at beginning of œsophagus pass abruptly to finer, rugose, transverse folds; hind gut, or large intestine, with thin translucent wall, sharply differentiated from thicker wall of the mid-gut; cloaca, into which hind gut passes, about twice as large as in *chilensis*.

Description.—Seitz (1907) has given a detailed account of the anatomy and histology of *Urechis chilensis*. In the present preliminary account it is not intended to go into detail, since the two species are quite similar in topographic

* The derivation of *Urechis* seems to be that of an imperfect anagram of *Echiurus*—scarcely *eupá* + *cús* (adder).

morphology. The figures are from specimens carefully hardened after anæsthetization.

U. caupo is cylindrical, roughly cigar-shaped, the posterior end rounded, the anterior end narrower and terminating in a short prestomial proboscis. This can be folded into a tube, the lining of which, continuous with that of mouth-cavity, is thrown into longitudinal folds.

The species reaches a large size, as apparently also does *chilensis* *. Our largest specimen when fully relaxed in anæsthesia was 19.5 inches (545 mm.) long, but after preservation measures about 15 inches (375 mm.) in length by 1.4 inches (35 mm.) in diameter. Another is 300 by 50 mm. These animals were undoubtedly very old. Average specimens are 150 to 180 mm. long.

In large specimens the two anterior, terminally curved, sharp setæ are situated 3 to 5 mm. back of the groove leading into mouth and about the same distance apart. They are metallic yellow, often brownish at tip, 8.5 to 10.5 mm. long. The flattened, curved, exerted portion is sharper than in *chilensis* and is directed backwards. Inside the body a shorter substitute seta lies close beside the functional one, as is the case with the anal bristles. The latter, ten or eleven in number, are slightly curved, slender, sharp, and the dorsal are longer (8.5 mm.) than the ventral (7.3 mm.). The dorsal are the only ones used to any extent in cleaning out the burrow. When digging, the posterior end of the body is bent sharply forward, underneath, so that the ventral setæ touch the ventral surface of the worm, while the strongly exerted dorsal bristles scrape the soil backward as the body is again straightened. This habit helps to explain the absence of a mid-ventral bristle, there being a broader gap at that point. Such a bristle would be useless, and would tend to cut the ventral surface of the worm. The anus is eccentric to the circle of setæ, being nearer the ventral side (centre of anus 6 or 6.5 mm. from dorsal bristles and 4 or 4.5 mm. from the ventral). All the bristles show conspicuous cross-banding.

The surface of the body is traversed by fine irregular channels giving a rugose appearance, which is most pronounced in the head region anterior to the zone of slime-glands.

The latter, a sort of clitellum, is usually distinguishable by the circular trend of its fine furrows. Its anterior border

* *Fide* Shipley, 'Zoological Results' (Willey), pt. 3, p. 342 (1899). Record of specimen of *E. farcimen*, Baird, 16 inches long.

coincides roughly with the second pair of segmental organs, while the posterior border is spaced behind the third pair a distance about equal to interval between the second and third pairs. This zone contains the compound "girdle glands" described by Seitz. The function of these will be described in a subsequent paper.

The spacious cœlom is filled with bright red blood, the pigment being lodged in subcircular cells, about .025 mm. in diameter, which readily distort when crowded. There are also very numerous amœboid cells which when aggregated are yellow in colour.

The alimentary canal resembles that of *chilensis*, but the hind gut, which is an organ of respiration, seems to have a thinner wall, since it is translucent even in preserved specimens. It is capable of even greater distension than shown in fig. 1. Seitz states, for *chilensis*, that in strength of wall- and muscle-layers the hind gut corresponds to the mid-gut. Where the mid-gut of *caupo* enters the hind gut there is a sharp demarcation of the thicker lining of the former. Furthermore, the hind gut shows the beginning of a slight anterior diverticulum.

The cloacal cavity of *caupo* is much larger than in *chilensis*, but consists of the same two parts, the posterior having prominent longitudinal folds of the mucous membrane. Its great similarity to the cloaca of a holothurian is undoubtedly due to its similar role in respiration. The two large nephridial vesicles which empty into the ventral part of the posterior chamber naturally recall the respiratory trees of holothurians. *Urechis*, however, pumps water into the large intestine, and not, so far as known, into the nephridia. Numerous ciliated funnels over the surface of the latter are easily demonstrated.

There is little valid distinction macroscopically between a buccal cavity and the pharynx. The latter is characterized by having its lining thrown into prominent longitudinal folds (Pl. IX. fig. 2), which really begin on the proboscis and run fairly straight to the œsophagus, where the structure of the lining changes abruptly into rugose, close, transverse ridges. The rugosities or papillæ show a somewhat quadrate outline. The posterior end of the pharynx coincides with the posterior limit of the two ventral mesenteries. Seitz states that in *chilensis* the pharynx, in contrast to the mouth-cavity, is provided with folds running zigzag and separated by deep sulci. For a stretch of about 5 mm. from the buccal cavity these run lengthwise, then across, and become somewhat weaker posteriorly. The same picture holds true for the anterior part of the œsophagus.

The fresh colours of the viscera in an anæsthetized specimen are: fore gut, pale flesh, or skin-colour; anterior third of mid-gut pale grey-green mottled with brown; middle third mottled yellow and dull grey-green; posterior third pale grey-green (pale jade-colour); accessory intestine, or siphon, pale jade-colour; hind gut or "lung" translucent raw sienna.

The figure shows sufficiently the position of the three pairs of segmental vesicles, with their extraordinary, long, coiled, ciliated lips, whose function is to collect germ-cells from the coelomic cavity. These vesicles become greatly distended with eggs. In one specimen examined the posterior tubes were 150 mm. long and 10 mm. in diameter, reaching two-thirds the total length of the animal. We have at this writing (September) a large male under observation in which the whitish tubes can be seen through the body-wall to extend fully two-thirds of the length of the body. Position of gonad unknown.

Eggs are mature in the latter part of the summer. They are extraordinarily clear, about 0.18 mm. in diameter, with a large nucleus containing a nucleolus which is 0.016 mm. in diameter.

Colour in life pale pinkish grey, or skin-colour. In alcohol, yellowish or brownish-grey.

Type.—In U.S. National Museum. Paratype will be deposited in the British Museum (Natural History).

Type-locality.—Elkhorn Slough, Monterey Bay, California.

EXPLANATION OF PLATE IX.

Reference letters.

- AS*. Anterior setæ; the accessory seta is shown at the side; muscles have not been drawn.
- AV*. Nephridial or anal vesicles.
- C1*, *C2*. Crop 1 and 2 of Seitz, subtended by muscular bands *M1* and *M2*.
- CL*. Cloaca, the posterior portion lined with heavy longitudinal ridges; arrows mark apertures of nephridial vesicles.
- G*. The gizzard ("Muskelkropf"), a portion of the fore gut lying between *C1* and *C2*, characterized by thick muscular walls and circular muscular ridges and constrictions.
- HG*. Hind gut or respiratory organ.
- M1*, *M2*. Muscular bands ("Muskelband") of crops 1 and 2.
- N*. Nerve-cord.
- O*. Oesophagus; the anterior limit is marked by an arrow.
- P*. Pharynx.
- PM*. Ventral mesenteries of pharynx.
- PS*. Posterior or anal setæ.
- S*. Siphon or accessory intestine ("Nebendarm").
- S1*. Beginning of siphon at beginning of mid-gut.

82 End of siphon in posterior part of mid-gut.

80. Segmental organs, filled with germ-cells.

1-13. These figures are in sequence along the mid-gut and are intended to aid in following the course; 13 is near the junction of mid-gut and hind gut.

Fig. 1. Dissection of *Urechis caupo*, from above. The principal mesenterial bands, which anchor the intestine to body-wall, are shown but not lettered. The coelomic apertures of the segmental organs are recognizable by the conspicuous coiled lips. The arrow indicates point where pharynx becomes oesophagus. The figures in sequence on the mid-gut are intended to aid in following the convolutions; 1 is at the beginning and 13 near the end. Beyond 13 the slight diverticulum of the hind gut is indicated.

Fig. 2. Pharynx slit open along ventral side to show the straight longitudinal folds of lining, continuous with those of the proboscis. The arrow indicates posterior limit of pharynx; below the arrow is shown characteristic lining of oesophagus; on either side are the dorsal mesenteries.

Fig. 3. Ventral surface of proboscis and anterior end of body.

Fig. 4. Posterior end of body showing eccentric anus and circle of setae; + marks and mid-ventral line.

Fig. 5. Two views of the anterior setae. The line indicates 1 mm.

Fig. 6. An anal seta, same scale as fig. 5 with, below, a tip enlarged.

Pacific Grove, California.

XVII.—*The Natural History of an Echiuroid Worm.* By
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[Plate X.]

THE following account concerns the behaviour and environment of a large echiuroid, *Urechis caupo**. This archaic creature dwells in the sandy mud of shallow bays and inlets of the California coast. It is one of three species constituting a genus sharply differentiated from the well-known *Echiurus* by very definite characters: a short proboscis, an extraordinary hind gut adapted for respiration, and a coelom crowded with large red blood-corpuscles, the blood-vascular system having disappeared.

Urechis is of special interest for its unique habit of spinning a tubular transparent net of marvellous efficiency, which allows water to flow through, but which intercepts

* Fisher and MacGinitie, "A new Echiuroid Worm from California," *Ann. & Mag. Nat. Hist.* ser. 10, vol. i. p. 199.

organisms and particles one micron in diameter. At a time probably so remote that mankind would have seemed a most improbable future experiment in adaptation, *Urechis* anticipated one of our modern plankton methods—namely, that of pumping sea-water through fine screens for the collection of nanoplankton. Furthermore, *Urechis* eliminates waste by devouring its net along with the catch. Such morsels as are too large for its fastidious gullet are cast out and fall to the necessities of its heterogeneous guests. Whence we likened the worm to a fat innkeeper (*caupo*).

Most of these observations were made from worms living in artificial burrows constructed of glass tubes, as well as in narrow glass-sided boxes filled with mud. We kept both tubes and "limoria" in ordinary aquaria fed by the salt-water system of the Station. As *Urechis* pays no attention to light, housekeeping operations were carried on during the day, as well as at night. Field-studies were made at a shallow estuary, tributary to Monterey Bay, where the water, although slightly warmer than that of the ocean (which here varies from 49° to 57° Fahrenheit), has practically the same salinity, there being usually a free interchange with each tide. In this inlet dwell a considerable variety of bivalves, some of which are much sought for food. There are two very interesting decapods, *Callinassa* and *Upogebia*, which, like *Urechis*, construct tunnels in the mud and conduct a more or less permanent ménage. The mud teems with annelids such as *Lumbrineris*, and there are literally acres which have a greenish tinge from the tentacles of *Phoronopsis harmeri*. *Zostera* grows in permanent patches and supports a characteristic association of animals. At favourable times wide expanses support a growth of green *Enteromorpha*, which, either fresh or decayed, is an important food-element, since the bulk of animal-life consists of detritus-feeders.

At low water broad areas are left bare, but *Urechis* usually drills its home where the entrances are not uncovered by the tide. A few places have been found where they are exposed at lowest tide.

The tunnel, never carried very deep, has two entrances and is in the form of a widely expanded U, of which the uprights are nearly perpendicular and the bottom horizontal. The apertures are small, being about one-third the diameter of the tunnel itself. Around one of the openings there is a considerable quantity of castings. The greatest distance between entrances measured 38 inches, the shortest 16 inches. Twenty-seven was the average for many measurements.

The distance apart of the two entrances depends upon the size of the animal, but not proportionately so, for small specimens have more extensive burrows for their size than larger ones. The largest specimen obtained was 19.5 inches long when relaxed in anæsthesia, and the smallest one inch.

The burrows have a permanent aspect, and none of those continually observed was found changed, except that occasionally one had a new entrance. The animals grow very slowly, so that enlargements need be made only at infrequent intervals, and then only by widening the U and extending one of the entrances.

Locomotion.—An *Urechis* can move along a smooth surface in much the same manner as an earthworm. It elongates the anterior part of the body, and then forces forward the viscera and the water contained in the respiratory gut by contracting the posterior region and relaxing the anterior. When most of the body-weight is in the anterior end the posterior portion is drawn up. These movements are repeated as the animal proceeds. Its method of locomotion within the burrow is quite similar, except that the animal has the added advantage of being able to wedge the anterior portion against the sides of the burrow. Its rapidity of locomotion approximates that of an earthworm. It can move considerably faster when in the burrow than when out of it, and it can move backward nearly as fast as forward.

Digging.—When digging the *Urechis* forces its proboscis ahead into the mud and works out a hole. When this is sufficiently long and wide the body is drawn ahead by expanding the anterior end for anchorage and then drawing up the remainder of the body. This process is continued until the worm completes a U-shaped tunnel open to the surface at both ends, so that a supply of fresh water may be pumped through the tube by peristaltic movements of the body.

The bore must now be enlarged to accommodate the activities of the owner. Material from the sides of the tunnel is scraped loose by the anterior hooks or setæ, worked backward with the anal setæ, and finally blown out the "back door" by a blast of accumulated respiration-water from the hind gut. To loosen sand from the sides of the burrow the oral setæ are protruded, then pulled backward through the soil. This digging is done on all sides of the burrow, as the animal can rotate its body at will. The setæ are shed occasionally and renewed.

The use of the anal setæ is highly characteristic, and was carefully observed. The anal setæ, of which there are ten or eleven, form a ring a short distance from the anus. The

sharp retractile bristles curve forward. The mid-ventral seta is lacking, and the pair on either side are distinctly shorter than the four or five dorsal setæ. When a certain amount of loosened débris accumulates from the activities of the anterior bristles, *Urechis* crawls over it and forces it backward in one of two ways: either by blowing the sand along with anal-water jets, augmented by the vigorous ventilating stream of the tube, or by turning under the posterior end of the body and then vigorously straightening it. The loosened material is pushed along the tunnel, whereupon the anal jet and ventilation current propel the finer detritus still further. The animal backs up and repeats the process. When the posterior end is folded under the dorsal setæ are strongly everted, and their forward curvature favours efficient scraping. The ventral setæ (now dorsal in position) are against the ventral body-wall and do not function. A reason for the smaller ventral setæ (and the absence of the mid-ventral seta) is now apparent, if we have faith in the efficacy of use and non-use in determining the relative size of similar organs.

Castings are sometimes ejected from the burrow by this flipping of the posterior end of the body (which can be admirably imitated with the forefinger), but usually only by water currents. Castings are allowed to accumulate, and then are ejected in quantity from one entrance. When digging downhill the animal propels the soil along the body and then out by backing up the burrow, forcing the sand out the last inch or two by water currents. The opening then resembles a miniature volcano with fine dark sand spouting out and the cloudy water trailing off like smoke from the crater. A major convulsion will carry out fragments of shells 2 or 3 mm. in section. Larger objects are avoided or allowed to fall toward the lower part of the burrow, where they are buried. Doubling the velocity of water increases its carrying efficiency directly as the sixth power. The narrowed mouth of the tunnel undoubtedly aids in increasing the force of these "volcanic" manifestations, and hence their efficiency in removing sizable débris.

Once an *Urechis* is settled in a permanent home its daily activities consist of respiratory movements, obtaining food, cleaning the burrow, and resting.

Respiratory Movements.—There are two separate movements concerned with the respiration of *Urechis*: (1) The peristaltic movements along the body which pump fresh water into the tunnel and move that within the respiratory chamber of the intestine; (2) the inhalations and exhalations.

tions, through the anus, for which the muscular cloacal chamber, resembling that of a holothurian, supplies the chief motive power.

The inhalations are from one to upward of thirty in succession (without an exhalation). Exhalation is usually a single discharge, although infrequently a rest may occur during a period of exhalation. The rate of breathing is not uniform. For instance, two inspirations covering twenty-five seconds were followed by an expiration period of ten seconds, while in another instance seven inspirations occupied twenty-five seconds, the expirations ten; twenty-four inspirations occupied seventy seconds, the single expirations fifty; thirty inspirations occupied ninety seconds, the expirations only twenty-five. Inspirations fewer than twelve predominate in a total of eleven cycles timed. These times were taken on a specimen lying in a pan of water. In its natural environment *Urechis* breathes more slowly, but with the same irregularity.

The peristaltic movements of the body which serve to propel water through the tube are even more erratic. The wave, which expands the body to fill the burrow, begins at the base of the proboscis and passes along the body at varying rates for different waves, or even the same wave in different parts of the body. As the wave arrives at the posterior portion of the body a new one begins at the anterior end. *Urechis* is normally always in control of the water, and senses anything which may attempt to pass through the burrow.

Food-getting.—The unique method employed by *Urechis* to gather nourishment is undoubtedly generic, and furnishes a striking example of the co-ordination of adaptive structure and behaviour.

A short distance back of the oral setæ is a rather narrow zone of compound mucus-glands, which form a sort of clitellum very faintly differentiated externally by the ring-like arrangement of the low rugosities of the skin. These glands are probably specializations of the simpler and more numerous multicellular flask-form mucus-glands of the integument. The girdle-glands, as they have been called, secrete a fairly long transparent mucus tube or funnel, whose upper open end is fastened near the mouth of the burrow, while the lower remains attached to the clitellum. This strains from the ventilating or respiratory currents all minute particles as the water flows through, and when sufficiently loaded the tube is swallowed. The process is repeated as long as the animal feeds. *Urechis* readily adopts a glass

substitute for its normal burrow, so that feeding reactions can be closely followed.

Just before starting a tube the body is constricted at the clitellum. This region is then expanded until it presses firmly against the sides of the burrow (usually near the mouth, but sometimes in the horizontal portion), with which it remains in contact for about two seconds. During the spinning process, which occupies only a few minutes, the constricted portion of the body anterior to the clitellum (whence the slime is issuing) undergoes a curious spiral peristalsis (Pl. X. fig. 5) easily detected by watching the nerve-cord which shows through the pink body-wall, whilst back of the clitellum the normal respiratory or pumping peristalsis is taking place.

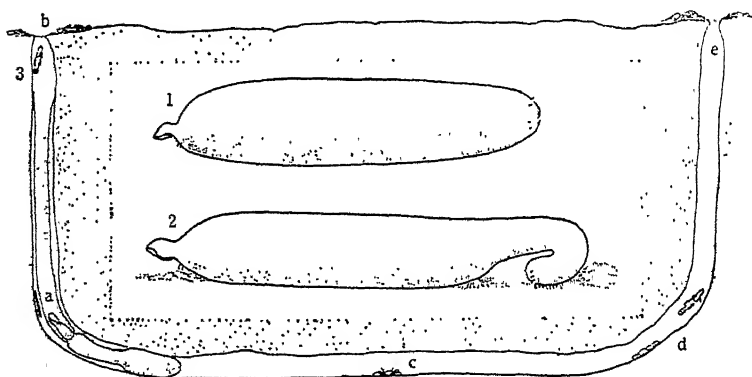
The tubes vary in length from about 2 to 8 inches without apparent reason. As the tube lengthens *Urechis* backs down the tunnel, and on completion the spiral peristalsis anterior to the clitellum ceases, being replaced by a faint normal peristalsis, the main wave starting just back of the attachment of slime-tube to the body. These normal ventilating reactions are kept up until the animal, apparently sensing the blocking of the water current by the clogging of the mucus with detritus, slips the tube forward "over its head." In doing this it deftly catches the hind edge of the tube by expanding the proboscis and bending it backward, collar-wise, against the inflated nuchal region, until the muscular pharynx is able to pick up and suck in a portion of the margin (Pl. X. fig. 7). When diatom culture or detritus is introduced with a pipette the slime-tube is soon swallowed; but, if unmolested, *Urechis* may continue pumping for an hour before the tube is clogged.

Usually but a few minutes are required for swallowing the tube, but the time depends upon length of tube and the amount of detritus intercepted. When the tube has been swallowed up to the point of attachment the animal makes a movement to release it from the sides of the burrow similar to the reaction while digging with oral setæ.

The food-funnel is porous to liquid, but will intercept the smallest particles. Phenol red passed through everywhere, but no carmine particles ever do. Under the microscope no openings can be detected, but particles approaching a micron in diameter are lodged in the mucus.

When first secreted the tube is perfectly transparent, but as it collects detritus it becomes grey and its outlines are easily seen. Peristalsis becomes more energetic as the tube-wall fills.

When spinning the tube or lying at its lower end pumping water through it *Urechis* is very sensitive to disturbances. If water is injected into the mouth of the tunnel the animal immediately ceases movement and remains perfectly still for a minute, then slowly resumes peristalsis. If the disturbance is too great it will drop out of the tube and retreat towards the centre of the burrow, returning later to eat the slime-tube. While it is lying at the end of a completed slime-tube any slight disturbance, such as the introduction of a little mud or fresh clam meat, will cause *Urechis* at once to pass the tube forward and begin swallowing. No large particles are ingested. They are rejected as the tube is being swallowed.



1. *Urechis caupo* in resting posture.
2. Position assumed while digging with anal setæ.
3. Plan of *Urechis* tunnel, the worm *in situ* pumping water through the slime-tube. Water enters at *b*, where there are two *Clevelandia* ias (one outside); at *a*, *Harmothoe* lies in wait to feed on tube when it shall be swallowed; *c*, *Scleroplax*; *d*, *Clevelandia* creating disturbance; *e*, eruption of mud cloud (from *d*) on ventilating current; castings around exit.

Cleaning the Burrow.—House-cleaning consists of removing castings and large particles dropped from the slime-tube as it is being swallowed. The mechanics have already been described under Digging.

Rest Periods.—After a more or less prolonged period of feeding *Urechis* retires to the horizontal portion of its burrow and assumes a characteristic resting attitude (text-fig. 1). The proboscis is shortened, and the body is everywhere pressed tightly against the burrow. The anal setæ are protruded and form a bristling ring round the anus.

The resting periods are of two sorts: (1) intermittent periods of from 4.5 to 8.5 minutes separated by about 1.5 minute intervals, during which water is expelled from the respiratory chamber and a new supply taken. (2) A continuous rest of an hour or more, during which respiration ceases (or at least is so reduced as to be imperceptible) and no movement of any sort takes place. During the intermittent "naps" the proboscis is sometimes moved slightly. The animal has never been observed to indulge in a protracted rest without first taking at least one or two short rests.

Commensals.—It is obvious that a permanent tubular dwelling with two "doors" and a ventilating current of water will entice temporary and permanent guests. Three commensals regularly lodge with *Urechis*: a goby (*Clevelandia ios*, Jordan & Gilbert), a polynoid annelid (*Harmothoe adventor*, Skogsberg), and a pinnotherid crab (*Scleroplax granulata*, Rathbun) (Pl. X. figs. 1-3).

For the goby the burrow is a retreat rather than a residence, as the little fish freely forages outside, returning when alarmed or when the entrance is left exposed by low tide. On such occasions from one to five gobies may be taken from the upper part of the tunnel. A goby left at the laboratory for several weeks in a glass burrow appeared contented. It would pass from one end to the other, wriggling past the *Urechis* as if accustomed to doing so.

Harmothoe and *Scleroplax* are permanent residents. Sometimes two crabs, a male and a female, are taken from one burrow, but two *Harmothoe* have never been found in the same tunnel. When a disturbance occurs both worm and crab rush to and remain in contact with their host.

Harmothoe, which ranges in length when alive from one-half inch to two inches, usually remains with its dorsal plates and notopodial setæ pressed against *Urechis*, and its ventral surface in contact with the soil. It moves from place to place with its host, making little runs between peristaltic waves, and turns end for end when *Urechis* does. After *Urechis* spins its mucus-tube *Harmothoe* may crawl forward and lie with its palps almost touching the proboscis. As soon as *Urechis* starts to devour the tube *Harmothoe* also sets to, making absurd little attacks on the yielding material with its eversible pharynx.

The crab usually does not exceed five-sixteenths of an inch (8 mm.) across the carapace, and the ventral surface is convex. It stands facing the side of burrow, the chelipeds turned up in front and the last pair of legs raised behind.

In this posture it can travel sidewise along the tunnel much faster than its host.

Enmity exists between crab and annelid in which the latter is under-dog. This feud may account for the close association of *Harmothoe* with *Urechis*. Both crab and annelid interfere with the regular activities of *Urechis*, especially its feeding and cleaning reactions. A particle of clam dropped into the slime-net is immediately sensed by both commensals. Their attempts to reach it cause *Urechis* prematurely to swallow the tube when the clam morsel is stripped out the open end. It is usually snapped up by *Harmothoe* and swallowed if small enough; otherwise *Scleropanax* will snatch it away, when the annelid must be content with what remains after the crab's appetite is satisfied.

On one occasion the goby seized the clam meat and, after several attempts to shake apart and swallow it, apparently deliberately carried the fragment to the crab and stood by to snatch bits as the meat was torn to pieces. This trait is not greatly in advance of a habit of these gobies of gathering in numbers around a large crab whilst it is devouring fish or clams found on the slough bottom. In similar manner they attend on the small shrimp *Spirontocaris paludicola* and profit largely thereby.

Enemies.—*Urechis* probably attains a ripe old age. Five specimens of different size, kept in mud in the laboratory for over a year, appear not to have grown. However, as their food is principally detritus, and as natural conditions are necessary to keep this stirred up in order that any quantity may be drawn into the slime-net, laboratory growth-tests are not convincing. Yet what might be termed the settled habits of the creature, and the scarcity of very small specimens, point strongly toward longevity. The only animal known to prey upon them is the sting-ray (*Myliobatus californicus*), which can dig out an occasional *Urechis*.

The period of mortality probably comes during the larval stage. The small goby (*Clevelandia ios*) is extremely numerous, darting here and there for any moving particles. These fish range from one-half to one and one-half inches in length, and often devour objects so small as to be invisible to the observer. On one occasion 400 of these little gobies were netted from a hole, three by six feet, left by clam-diggers. In addition, the tiny *Urechis* must run the gauntlet of a host of small predaceous crustaceans, annelids, nemerteans, and molluscs which forage on the surface and in the upper layers of mud. Once established in a burrow *Urechis* is relatively safe.

We are greatly indebted to Dr. Tage Skogsberg, of the Hopkins Marine Station, for the preliminary diagnosis of the *Harmothoe*, as follows:—

Harmothoe adventor, Skogsberg, sp. n.

(Pl. X. fig. 3.)

Body depressed; ratio between length and width, 2.7 to 3.4:1; maximum length about 40 mm. Number of somites thirty-seven or thirty-eight: Anus on pygidium. Elytra cover body completely, or mid-dorsal region naked; fifteen in number; present on somites ii., iv., v., vii. and on alternate somites to xxiii. inclusive, and then on xxvi., xxix., xxxii.; naked, with moderate number of rounded tubercles along edge. Prostomium 1.4 to 1.7 times longer than wide, with two small mammilliform anterior processes which sometimes are nearly absent. Two pairs of eyes of moderate size on posterior half of prostomium. Median tentacle about twice as long as lateral tentacles, subequal in length to prostomium. Dorsal cirri long. Tentacles, palpi, and cirri with minute papillæ. Each notopodium and neuropodium near middle of body with 50 to 100 bristles, all with simple tips and distinct pectination; notopodia, as well as neuropodia, with two kinds of bristles. Some of notopodial bristles stronger than neuropodial, with strong tips; others weak, with thread-like tips. Some of neuropodial bristles with pectination along distal one-fourth to one-sixth and with strong tips; others with pectination along distal one-half to one-third and with thread-like tips. Each somite with dorsal cross-band of pigment.

Pacific Grove, California.

EXPLANATION OF PLATE X.

- Fig. 1.* Portion of tunnel of *Urechis caupo* showing one position of worm while pumping water through its slime-net and characteristic stations of commensals; $\times \frac{2}{3}$; A, *Clevelandia ios*, at mouth of tube; B, *Harmothoe adventor*; D, *Scleroplax granulata*. At upper point where the tube is interrupted one inch has been omitted, at lower point four inches.
- Fig. 2.* *Scleroplax granulata*, Rathbun, male, $\times 3$.
- Fig. 3.* *Harmothoe adventor*, Skogsberg, type, $\times 1$.
- Fig. 4.* *Urechis caupo*; the slime-tube is in place with the thickening at point of attachment to body indicated. The worm is shown in characteristic pumping posture; $\times 3$.
- Fig. 5.* Characteristic posture while tube is being secreted; tube just begun; entrance indicated by dots; $\times 1\frac{1}{2}$.
- Fig. 6.* Expression of worm while swallowing slime-tube.
- Fig. 7.* Grasping slime-tube at moment of starting to swallow. The proboscis is holding the posterior edge of tube while a portion is being sucked in on ventral side. This step occupies about three seconds.

XVIII.—*The British Tomopteridæ.* By W. HAROLD LEIGH-SHARPE, M.Sc. (Lond.), Lecturer in Zoology, Chelsea Polytechnic, London.

[Plate XI.]

THIS pelagic family of the order Nereidiformia of Polychæte worms is represented in British waters by a single species which has a range over the north and tropical Atlantic, including the Mediterranean area. This species has passed variously as *Tomopteris onisciformis* and *T. hetgolandica* in the fauna and lists of the Marine Biological Association, Plymouth, but the name *Tomopteris (Johnstonella) catharina*, Gosse, 1881, appears to have priority, since this species is not the same as *T. onisciformis*, Eschscholtz, 1825.

It soon became necessary to divide the genus *Tomopteris* into two subgenera. For one subgenus the name *Tomopteris* was retained; to the other the name *Johnstonella* was given. To the latter subgenus the British species belongs.

The genus *Tomopteris* may be first of all distinguished from the genus *Enapteris* (the only other genus in the family) by having:—

- (a) The brain oval (generally in a transverse direction), and not pointed anteriorly (Pl. XI. fig. 1, *Br.*).
- (b) Eyes large (Pl. XI. fig. 1).
- (c) The pharynx stout and long, reaching internally as far as the first parapodium (Pl. XI. fig. 1, *Ph.*).
- (d) The rami of the parapodia more or less conical and furnished with a "fin-like" border (Pl. XI. fig. 2, *f.m.*).
- (e) The second pair of tentacles (cirri) long, but not as long as the body (Pl. XI. fig. 1, *T.*).

The subgenus *Tomopteris* has the rosette wanting; almost always both the tail and often the first pair of tentacles are absent.

The subgenus *Johnstonella* has the rosette present (Pl. XI. fig. 2, *R.*); almost always the tail and the first pair of tentacles are present, but the crystalline gland is almost always absent.

The specific characters of *Johnstonella catharina* are that it has the rosette on the ventral ramus of the first and second pairs of parapodia, on the "fin-borders"; a tail is present (Pl. XI. fig. 3); there is a single chromophilous "gland" (Pl. XI. fig. 2, *ch.or.*) on the "fin" of the

ventral ramus of the parapodia, but which has no sharp-pointed organ called the "spur" in connection with it. There are gonads in *both* rami of the parapodia.

In common with the whole family, *Johustonella catharina* is a pelagic animal, and has been taken in tow-nettings from the plankton at Plymouth during most, if not all, months of the year. The body is colourless and transparent, but some authors have distinguished in the living animal a series of red dots along the second cirri and elsewhere, above all, along the ventral ganglion chain. It attains, on an average, a length of about 16 mm., of which about one-quarter is occupied by the tail. The specimens in my possession are all from 15-16 mm. The largest specimen on record, according to Bush, is one from Heligoland, of 17 mm., of which 5 mm. are occupied by the tail.

The *parapodia* are long and biramous and up to twenty-one pairs in number, of which a quarter are caudal and rudimentary, usually six pairs. Each ramus is surrounded by a membrane or fin for use in swimming on the surface. None of the parapodia are chætigerous. *Chætæ* are, in fact, absent from the animal except for two pairs at the head (or, according to one author, three pairs). These chætæ are in the two pairs of tentacles of the so-called prostomium. This is unnatural, since no other animal bears chætæ in the prostomium. It has therefore been suggested that the prostomium has disappeared, and that the chætæ are postoral and have shifted forwards.

The so-called *prostomium* is furnished at most with two pairs of tentacles or cirri; in this species it is joined to the body by a narrow neck, has relatively short horns (Pl. XI. fig. 1, *Pr.*) and a deep frontal incision.

The *brain* is oval—i. e., elliptical in a transverse direction with a short major axis—and slightly bilobed. There are two large *eyes* with lenses. The ciliated ridges or *epaulettes* (Pl. XI. fig. 1, *E.*) on either side of the prostomium are broad and converge posteriorly. Carpenter and Claparède stated that two otocysts are present in the anterior region of the brain, but this statement is not confirmed by later observers.

The *pharynx* is relatively short for the subgenus and half bent inwards. There are no jaws.

The *first pair of tentacles or cirri* are often wanting. They are not present in any of the specimens taken by me at Plymouth, or which have come under my examination. These consist of six specimens taken by myself at Plymouth in May 1912, four and two specimens taken by others at

Plymouth in May 1913 and May 1914 respectively, one specimen taken at Plymouth in May 1926 and one in June 1927; a specimen from Heligoland and another from Gibraltar. When present these tentacles are stated to be a little less long than the "horns" of the prostomium, and bear one pair of chætæ ventrally (one author says two pairs).

The *second pair of tentacles or cirri* are very long and directed backward, being about two-thirds of the total length of the body. They bear one pair of supporting chætæ (Pl. XI. fig. 1, *T.*).

The *rosette* is the name given to an organ said to be photogenic. It consists of a crown of yellow globules surrounded by a rosette of pyriform cells, hence its name. The position of the rosettes on the rami of the parapodia, or more actually on the fin-membranes, is taken as a specific character. A single rosette appears on the *ventral ramus* of the first two pairs of parapodia. On the other parapodia there are two rosettes, one on the "inner" side of each fin-membrane in contact with the ramus. According to Leuckart and Pagenstecher the position of the rosette is a little variable, at from one-third to two-thirds the length of the ramus. The position of the rosettes in my specimens is as I have shown in Pl. XI. fig. 2, *R.*

The "*glands*" on the fin-membrane are of *one kind only*—namely, the so-called chromophilous. Crystalline glands are not present. There is one chromophilous gland to each parapodium situated about three-quarters the length of the inferior fin. Here there appears to me to be some confusion; as, though I have not had the opportunity of examining crystalline glands in other species, which are stated to consist of tubules, yet, from illustrations, the chromophilous gland of this species resembles what is called the crystalline gland and not the chromophilous gland in other species. The organ in this species does not appear to me to be of a glandular nature at all. Instead of consisting of tubules, in my opinion, it consists of curved and elongated spindle-shaped cells, each with a central nucleus, packed round one another in series resembling the leaf-bases in the "coats" of an onion or, more correctly, the scaly bulb of the Turk's-cap lily (*Lilium martagon*), exactly recalling the "taste-buds" of the circumvallate papillæ of the mammalian tongue. I suggest that this organ is not a gland but a sense-organ (Pl. XI. fig. 2, *ch.or.*).

Gonads are present in *both* rami of the parapodia. Since all the specimens I have examined and those figured in

papers—*e. g.*, Rosa (1908)—show eggs, it would seem that the number of females greatly preponderates over that of the males.

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EXPLANATION OF PLATE XI.

- Fig. 1. *Johnstonella catharina*. The entire animal. *Pr.*="horns" of the prostomium; *E.*=epaulettes; *T.*=second pair of tentacles; *Ph.*=pharynx; *Br.*=brain.
 Fig. 2. *Johnstonella catharina*. A single parapodium (*P.*) with *r* its two rami. *Ov.*=ovaries; *f.m.*=fin-membranes; *R.*=rosettes; *ch.or.*=chromophilous organ.
 Fig. 3. *Johnstonella catharina*. Another variety of "tail."

XIX.—*New or little-known Tipulidæ (Diptera).*—XXXVIII.
Australasian Species. By CHARLES P. ALEXANDER, Ph.D.,
 F.E.S., Massachusetts Agricultural College, Amherst,
 Massachusetts, U.S.A.

THE species discussed in the present paper are Australian members of the tribe Hexatomini, the majority of the specimens having been taken in Tasmania by Dr. André L. Tonnoir. A few of the species were included in collections made in Tasmania by Mr. Hardy, in Victoria by Director Kershaw of the National Museum and Mr. F. E. Wilson, and on Mt. Kosciusco by Dr. Tillyard. I wish to express my gratitude to all the above-mentioned gentlemen for the opportunity of studying this and abundant additional material in the Tipulidæ. The Tonnoir collections have been returned to Dr. Tonnoir.

The localities in New South Wales, Victoria, and Tasmania where the Tonnoir collections were made have been discussed in an earlier part of this series of papers (Ann. & Mag. Nat. Hist. (9) xix. pp. 18-19, 1927).

Limnophila recta, sp. n.

General coloration dark brown, sparsely pollinose; antennæ short; wings with a faint yellow tinge; stigma pale; wing-disk with a sparse handsome brown pattern; no macrotrichiæ in cells of wing; Sc_1 and Sc_2 beyond the fork of Rs ; cell M_1 present; inner end of cell 1st M_2 arcuated; male hypopygium with the outer dististyle straight, the apex simple, truncate.

Male.—Length about 8.5 mm.; wing 9.6 mm.

Rostrum and palpi brownish black. Antennæ short, if bent backward not extending far beyond the pronotum, dark brown throughout; flagellar segments cylindrical with verticils that are equal to or a little longer than the segments. Head dark grey, the anterior vertex more yellowish with a dusky mark.

Pronotum dark brown, sparsely pollinose. Mesonotal præscutum dark brown, the interspaces slightly yellowish pollinose to leave indications of three slightly indicated stripes of the ground-colour; pseudosutural foveæ black, lying close to the lateral margins. Pleura brownish grey with a short, narrow, darker brown stripe across the anepisternum. Halteres relatively elongate, pale, the knobs more yellowish. Legs with the coxæ testaceous brown, the fore coxæ darker; trochanters brownish yellow; femora brown, paler at base, the tips dark brown; tibiæ light brown, the tips narrowly dark brown; tarsi toward tips passing into dark brown; segments of legs rather conspicuously setiferous. Wings with a faint yellow tinge, the costal region faintly infuscated; stigma pale; wing-disk with a handsome brown pattern, arranged as follows: at base of cells R and M ; origin of Rs ; Sc_2 ; along cord and outer end of cell 1st M_2 ; end of Rs ; fork of M_{1+2} ; ends of all longitudinal veins beyond M_3 ; vein Cu_1 and anal angle seamed with brown; veins brown, darker in the infuscated areas. No macrotrichiæ in cells of wing. Venation: Sc long, both Sc_1 and Sc_2 placed beyond the fork of Rs , Sc_2 near the tip of Sc_1 and exceeding it in length; R_2 dividing the pale stigma, about two-thirds R_{1+2} , and about one-third or less of R_{2+3} ; Rs elongate, angulated at origin; inner ends of cells R_4 , R_5 , and 1st M_2 in very oblique alignment, the latter being strongly arcuated at inner end; cell M_1 about equal to its petiole; $m-cu$ beyond mid-length of cell 1st M_2 , about in alignment with the basal deflection of R_5 ; m shorter than the deflection of M_2 ; anterior arculus present.

Abdomen dark brown, the basal sternites more brownish yellow, except at base; hypopygium dark. Male hypopygium with the basistyles relatively stout, the mesal face at base with longer setæ; interbasal process blunt at tip. Outer dististyle broad, nearly straight, the apex simple, truncated; inner style shorter, setiferous at base. Each gonapophysis with two pointed blades. Caudal margin of ninth tergite with a very shallow notch.

Hab. Tasmania.

Holotype, ♂, Mt. Farrel, February 9, 1923 (*A. Tonnoir*).

Limnophila kershawi, sp. n.

General coloration brown; antennæ small; halteres elongate, pale yellow throughout; wings with a creamy-yellow tinge, in cases sparsely spotted with dark brown, including a larger cloud at the outer ends of cells R_3 and R_4 , in still other cases the wings more uniformly yellow, the spots scarcely indicated.

Male.—Length about 10–12 mm.; wing 10·8–12 mm.

Rostrum and palpi black. Antennæ with the basal segment dark brown, the second segment yellowish brown; flagellum dark brown, the incisures of the basal segments paler; antennæ relatively small, if bent backward not attaining wing-root; flagellar segments elongate-cylindrical to subfusiform, the verticils a trifle longer than the segments. Head dark grey, the anterior vertex relatively narrow; head somewhat narrowed behind.

Pronotum large, brownish grey. Mesonotal præscutum light brown, sparsely pollinose, with three vaguely defined darker stripes, the median area in front with a small blackish line; tuberculate pits lacking; pseudosutural foveæ relatively inconspicuous and lying close to the margin; scutum dark brown; scutellum and postnotum light brown, the latter with indications of a capillary dark line. Pleura brown, the dorso-pleural region somewhat darker brown. Halteres elongate, pale yellow throughout. Legs with the coxæ brownish yellow, the fore and middle coxæ more infuscated; trochanters brownish yellow, the mesal face with a black spot; remainder of legs long and slender, with short inconspicuous setæ; femora brown, the extreme base paler, with a narrow brownish-black subterminal ring, the extreme apex again paler; tibiæ brownish yellow, the tips narrowly dark brown; basitarsi yellowish brown, the tips passing into dark brownish black; remainder of tarsi black. Wings with a creamy-yellow tinge, cells C and Sc faintly infumed, their outer ends paler, the usual stigmal region

oval, white; a restricted dark brown pattern distributed as follows: in base of cell R ; a circular spot at origin of Rs ; Sc_2 ; a cloud at proximal end of stigma, in alignment with a narrow seam along the cord that is broader anteriorly, very restricted at vein M ; outer end of cell 1st M_2 ; outer ends of cells R_2 and R_3 strongly and conspicuously darkened; small brown clouds at fork of M_{1+2} , and marginal spots on veins M_3 to 2nd A , the latter large; a small dusky spot before mid-length of the margin of cell 2nd A ; a vague darker cloud along vein Cu_1 ; veins brown, darker in the infuscated areas. Venation: Sc_2 at tip of Sc_1 and exceeding the latter in length; R_2 very faint, R_{2+3} about one-half R_3 , both sinuous; Rs elongate; inner ends of cells R_4 , R_5 , and 1st M_2 in oblique alignment, the latter lying more basad; cell M_1 one-half longer than its petiole; $m-cu$ beyond mid-length of cell 1st M_2 ; anterior arcus present.

Abdominal tergites dark brown, the lateral margins broadly blackened; sternites paler; segments 8 and 9 and the hypopygium paler brown. Male hypopygium with the basistyles relatively long, the mesal face with numerous long conspicuous setae. Outer dististyle blackened, clavate, a little widened outwardly, the tip very weakly and inconspicuously bifid; a small darkened tubercle near the base of the style; surface of style with delicate erect setae. Inner dististyle more fleshy, densely covered with erect setae. Gonapophyses appearing as broad, flattened, yellow blades, the outer surface and margin weakly spinulose. Aedeagus of moderate length, spiraled at base. Caudal margin of the ninth tergite with a small U-shaped median notch, the lobes thus formed subtruncate at their tips.

Hab. Victoria.

Holotype, ♂, Marysvale, April 1925 (*J. A. Kershaw*), in the National Museum, Victoria.

Paratypes, 3 ♂ ♀, Sassafras, Dandenong Range, October 19–20, 1922 (*A. Tonnoir*).

This interesting species is named in honour of Director Kershaw, of the National Museum, Victoria, who collected the type-specimen and to whom I am greatly indebted for many kind favours. The Sassafras paratypes have the wing-pattern much paler, almost uniformly pale yellow, with the dark spots barely indicated. The femora are paler brown to almost yellow, with a relatively narrow darker brown subterminal ring. Despite these differences I must regard the flies as being conspecific, at least until additional data are forthcoming. The female specimen mentioned above is in too poor condition to be made the allotype.

Limnophila jucunda, sp. n.

Belongs to the *jucunda* group; general coloration dark brown, with a sparse yellow pollen; antennæ short; wings with a faint yellow tinge, handsomely variegated with brown spots; Sc_2 at tip of Sc_1 , both lying before the fork of Rs ; cell M_1 present; no macrotrichia in cells of wings; male hypopygium with the outer margin of the outer dististyle spinulose back from the tip; interbasal process long and sinuous, acute.

Male.—Length about 5.5 mm.; wing 7.2 mm.

Female.—Length about 7 mm.; wing 7.3 mm.

Rostrum and palpi black. Antennæ relatively short, if bent backward extending to about mid-distance of the posterior margin of the pronotum and the wing-root, brownish black throughout; basal flagellar segments cylindrical with the lower face bulging, the segments soon becoming elongate-cylindrical to fusiform, with long conspicuous verticils that exceed the segments in length. Head broad, dark brownish grey.

Pronotum dark brown. Mesonotal præscutum dark yellowish brown, in most cases without distinct markings, in others with intermediate dark stripes indicated behind; both pseudosutural foveæ and tuberculate pits well defined, shiny black, the former placed only a little caudad of the level of the latter, lying transversely, elongate; scutum and scutellum brown with a very sparse yellow pollen; postnotum darker brown than the remainder of the mesonotum. Pleura dark brown, the meron obscure yellow. Halteres short, pale, the knobs light yellow. Legs with the coxæ obscure brownish yellow; trochanters obscure brownish yellow, the inner face at apex darker; femora obscure yellow, with long conspicuous scattered setæ; tibiæ brownish yellow, the tips narrowly infuscated; tarsal segments brownish yellow, passing into darker brown. Wings with a faint yellow tinge, the base and costal region somewhat brighter; a conspicuous brown pattern distributed as follows: at h ; beyond arculus in cells R and M ; origin of Rs ; tips of Sc_1 and Sc_2 ; stigma; cord and outer end of cell 1st M_2 ; fork of M_{1+2} ; marginal clouds at ends of veins R_3 , R_4 , and the veins beyond M_2 , that at Cu_1 most extensive; veins yellow, darker in the infuscated areas. No macrotrichia in cells of wing; on veins relatively sparse, there being none on Rs , R_{2+3+4} , M , Cu_1 , or the Anal veins excepting the distal portion of 1st A . Venation: Sc_1 ending about opposite three-fourths the length of Rs , Sc_2 at its tip;

Rs angulated at origin; R_2 subequal to R_{1+2} and nearly one-third R_{2+3} ; cells R_4 , R_5 , and 1st M_2 in transverse alignment; cell 1st M_2 elongate, the outer deflection of M_3 usually much longer than the shorter transverse m ; cell M_1 shorter than its petiole; $m-cu$ approximately its own length or more beyond the fork of M ; anterior arculus faint to apparently lacking. The allotype female has an adventitious cross-vein in cell R_3 of both wings (as in *Dicranophragma*); the paratype male from King River has similar adventitious cross-veins in cell M of both wings (as in *Ephelia*).

Abdomen dark brown, the caudal margin of the third tergite vaguely paler; basal sternites with the caudal margins indistinctly obscure yellow. Male hypopygium with the basistyles relatively slender; interbasal process a long, slender, recurved rod, strongly sinuous to the acute apex, the base dilated. Outer dististyle relatively short, chitinized, nearly straight, terminating in a small apical spine, the outer margin back from the tip with smaller and more slender appressed spines that become smaller basally, obsolete at near mid-length of the style; base of style with a few scattered setæ; inner dististyle fleshy, with numerous setæ, including a group of eight to ten elongate bristles at the tip. Ædeagus and gonapophyses short and inconspicuous. Ninth tergite with the median area protuberant, truncated. Ovipositor with the tergal valves long and slender, horn-coloured.

Hab. Tasmania.

Holotype, ♂, Hartz Mts., December 10, 1922 (*A. Tonnoir*).

Allotype, ♀, Strahan, February 1924 (*G. H. Hardy*), in the University of Queensland Collection.

Paratypes, 1 ♂, King River, February 4, 1923 (*A. Tonnoir*); 1 ♂, Strahan, February 6, 1923 (*A. Tonnoir*).

Limnophila jucunda varies considerably in the venation and relative extent of the dark pattern of the wings. I think it is highly probable that more than a single species may be involved in this complex and that the specimens with extra cross-veins in the wings may represent valid species. More material will be needed before this can be decided.

Limnophila subjucunda, sp. n.

Belongs to the *jucunda* group; antennæ short; præscutal stripes indicated behind; wings with a creamy ground-colour, heavily patterned with brown, this including a large area in cell M before mid-length and conspicuous marginal spots at the ends of the longitudinal veins.

Male.—Length about 6 mm.; wing 7.2–7.3 mm.

Rostrum and palpi brown. Antennæ short, if bent backward not surpassing the pronotum; dark brown, the scapal segments weakly pruinose; flagellar segments oval with verticils that exceed the segments. Head grey with a yellowish pollen, most conspicuous on the anterior vertex.

Pronotum dark brown, pruinose. Mesonotal præscutum yellowish grey with an intermediate pair of narrow dark brown stripes, most evident behind; lateral stripes faintly indicated; both pseudosutural foveæ and tuberculate pits evident, black; posterior sclerites of the mesonotum dark brown, heavily pruinose. Pleura brownish grey. Halteres yellow. Legs with the fore and middle coxæ brown, sparsely pruinose, the posterior coxæ obscure yellow; trochanters yellow; femora obscure yellow, the tips narrowly infuscated; tibiæ brownish yellow, the tips narrowly dark brown; basitarsi light brown, the tips and remainder of tarsi dark brown; segments of the legs with conspicuous semi-erect setæ. Wings with a creamy ground-colour, heavily spotted and clouded with brown; basal half of cell *C* clouded; the brown clouds are largely circular in outline, distributed as follows: bases of cells *R* and *M*; at two-fifths the length of cell *M*; at origin of *Rs*, not quite reaching vein *M*; tip of *Sc*₁ and *Sc*₂; stigma; cord and outer end of cell 1st *M*₂; fork of *M*₁₊₂; tips of all the longitudinal marginal veins except *R*₅, smallest on *M*₁, becoming larger posteriorly toward the wing-base; dusky washes in basal half of cell *Cu*, along vein 2nd *A*, and in the anal angle; veins brown. No macrotrichia in apical cells of wing. Venation: *Sc*₁ ending opposite three-fourths the length of *Rs*, *Sc*₂ at its tip; *R*₂ a little longer than *R*₁₊₂ and about one-third *R*₂₊₃; *R*₂₊₃₊₄ longer than *m-cu*; cell *M*₁ present, about equal to its petiole; *m-cu* near mid-length of cell 1st *M*₂; anterior arculus present. A weak spur from vein *M* into cell *M* near two-fifths the length of the vein.

Abdomen dark greyish brown, the hypopygium a little paler. Male hypopygium generally as in *L. jucunda*, sp. n., in the very short ædeagus, the long strongly curved interbases, and the spinulose outer dististyle.

Hab. Tasmania.

Holotype, ♂, Burnie, February 1, 1923 (*A. Tonnoir*).

Paratopotype, ♂.

Limnophila suspecta, sp. n.

Belongs to the *jucunda* group; general coloration brown, the præscutum with two intermediate darker stripes behind;

antennæ short; wings pale brownish yellow with very pale darker clouds along the cord and outer end of cell 1st M_2 ; no macrotrichia in cells of wing; cell M_1 present.

Male.—Length about 4.5 mm.; wing 5.3–5.5 mm.

Female.—Length about 5.5 mm.; wing 6.8 mm.

Rostrum and palpi dark brown. Antennæ short, if bent backward not extending far beyond the pronotum, dark brown, the basal segment a little paler; flagellar segments oval with verticils that are much longer than the segments. Head broad, brown, with a yellow pollen.

Pronotum dark brown, sparsely pollinose, the posterior notum paler. Mesonotal præscutum brown, with two intermediate darker brown stripes that are better indicated on the posterior half; both pseudosutural foveæ and tuberculate pits present, the latter placed at about mid-distance between the cephalic margin and the level of the foveæ; scutum dark grey; scutellum lighter grey; postnotum dark brown, sparsely pruinose. Pleura dark brown, sparsely pruinose; dorso-pleural region paler. Halteres of moderate length, yellow throughout. Legs with the coxæ brownish yellow, the fore and middle coxæ more infuscated; trochanters obscure yellow; femora yellowish brown, tibiae slightly darker, the tarsal segments passing into dark brown; segments of legs with long outspreading setæ. Wings with a pale brownish-yellow tinge, the prearcular region more whitish yellow; stigma oval, brown; broad, pale brown clouds along the cord and outer end of cell 1st M_2 ; anal angle slightly darkened; veins brown. No macrotrichia in cells of wing; those of the veins relatively sparse, virtually restricted to beyond the level of the cord. Venation: Sc_2 at extreme tip of Sc_1 , ending about opposite three-fourths the length of Rs , the latter angulated at origin; R_2 faint, subequal to R_{1+2} and varying from about one-half to nearly equal to R_{2+3} ; cell M_1 present but small, approximately one-third to one-half its petiole; $m-cu$ about its own length beyond the fork of M .

Abdomen dark brown, including the hypopygium; basal sternites a very little brighter. Male hypopygium generally as in *L. jucunda*, sp. n., dististyles very small, the inner style stout and nearly equal in length to the outer one. Interbasal processes very long and slender, acicular. Ovipositor with the valves very long and slender, light horn-colour, the bases narrowly darkened.

Hab. Tasmania.

Holotype, ♂, Burnie, October 26, 1922 (*A. Tonnoir*).

Allotopotype, ♀

Paratopotypes, 2 ♂ ♂.

Limnophila suspecta differs from *L. jucunda*, sp. n., in the diffusely patterned wings and the details of venation.

Limnophila suspecta invariegata, subsp. n.

Close to typical *suspecta*, but without dark markings on the wing other than the oval stigma. Wings broader, the cells being somewhat wider.

Hab. Tasmania.

Holotype, ♂, Cradle Valley, January 16, 1923 (*A. Tonnoir*).

Allotype, ♀, Mt. Field, December 18, 1922 (*A. Tonnoir*).

Limnophila tigriventris, sp. n.

Belongs to the *jucunda* group; general coloration dark brown, including the pleura; femora brownish yellow, the tips clearer yellow; wings with a faint dusky tinge, the veins indistinctly seamed with darker brown; abdomen dark brown, the intermediate segments broadly margined caudally with yellowish.

Female.—Length about 6 mm.; wing 6·7 mm.

Rostrum and palpi dark brown. Antennæ of moderate length, if bent backward extending to shortly before the wing-root, dark brown throughout; flagellar segments elongate-oval with conspicuous verticils that are nearly twice the length of the segments. Head dark brown.

Mesonotum shiny dark brown, the præscutum darker medially, only sparsely dusted with yellowish pollen; pseudosutural foveæ present; tuberculate pits at mid-distance between foveæ and cephalic margin of præscutum. Pleura dark brown, very sparsely pollinose. Halteres yellow. Legs with the coxæ yellowish testaceous; trochanters brownish yellow; femora pale brownish yellow, the tips broadly clearer yellow; tibiæ yellowish brown, the tips narrowly infuscated; tarsi brownish testaceous, the terminal segments darker; segments of legs with long conspicuous setæ. Wings with a faint dusky tinge, the veins indistinctly seamed with darker; stigma oval, darker brown; dark seams at origin of *Rs*, along cord and outer end of cell 1st *M*₂, on veins *Cu*₁ and 2nd *A*; anal angle darkened; veins dark brown. No macrotrichiae in cells of wing. Venation: *Sc*₁ ending shortly before the fork of *Rs*, *Sc*₂ about its own length from the tip; *Rs* strongly arcuated at origin; *R*₂ close to the tip of *R*₁₊₂ and a little shorter than *R*₂₊₃; *R*₂₊₃₊₄ nearly twice *m-cu*; cell *M*₁ longer than its petiole; cell 1st *M*₂ large,

equal in length to vein M_3 beyond it, gently widened outwardly; m straight, the outer deflection of M_3 a little longer, strongly arcuated; $m-cu$ nearly its own length beyond the fork of M .

Abdomen dark brown, segments 2 to 5 with broad conspicuous yellow rings on the caudal margins, producing a banded appearance. Ovipositor with the tergal valves pale horn-colour, gently upcurved to the acute tips; sternal valves blackened at base.

Hab. Tasmania.

Holotype, ♀, Strahan, February 1924 (*G. H. Hardy*), in the University of Queensland Collection.

Limnophila lepida, sp. n.

Belongs to the *ocellata* group; general coloration light brown; antennæ short; pleura grey pruinose; wings with a brownish-yellow tinge, variegated with a sparse solid brown pattern that is confined to the vicinity of the veins; Sc_1 shorter than $m-cu$, the latter beyond mid-length of cell 1st M_2 .

Male.—Length 3·5 mm.; wing 4·5 mm.

Rostrum and palpi brown. Antennæ short, if bent backward extending slightly beyond the pronotum, dark brown; flagellar segments cylindrical, slightly dilated near mid-length and here with elongate verticils which are about one-half longer than the segments. Head brownish grey.

Mesonotal præscutum light greyish brown with three indistinct darker brown stripes, the lateral margins of the segment slightly pruinose; pseudosutural foveæ and tuberculate pits both conspicuous, black, in approximate transverse alignment, the tuberculate pits lying very far back on the præscutum; scutum brown, sparsely pruinose; scutellum and postnotum lighter grey. Pleura brown, sparsely grey pruinose, with two narrow, dusky, longitudinal stripes. Halteres pale yellow. Legs with the coxæ brownish testaceous; trochanters yellowish brown; remainder of legs pale brown, the terminal tarsal segments infuscated. Wings with a brownish-yellow tinge, the base and costal margin clearer yellow; a sparse pale brown pattern that is not at all ocelliform, consisting of simple circular or oval clouds distributed as follows: beyond arculus in bases of cells R and M ; origin of Rs ; tip of Sc ; along cord; on R_2 and fork of R_{2+3+4} ; outer end of cell 1st M_2 ; conspicuous marginal clouds at ends of longitudinal veins, excepting R_4 and R_5 ; a dusky cloud near mid-length of vein 1st A ; veins

brown, a little darker in the clouded areas. Venation: Sc_2 rather far out toward the tip of Sc_1 , the latter alone about equal to m ; R_2 close to the tip of R_{1+2} and a little shorter than R_{2+3} ; cell M_1 present, about two-thirds its petiole; cell 1st M_2 elongate, widened distally, $m-cu$ beyond mid-length. Wing widest immediately basad of the apex of the long vein 2nd A .

Abdomen dark brown, the subterminal segments somewhat darker; hypopygium obscure yellow. Male hypopygium with the basistyles long and slender, without a distinct interbasal process. Dististyles two, the outer slender, blackened, clavate, the apex truncated, with the outer apical angle microscopically spinulose; outer margin of style on distal half with a few long setæ. Inner dististyle a little shorter and much stouter, pale, with setæ. Gonapophyses small flattened blades, each terminating in an elongate beak. *Ædeagus* very short and stout.

Hab. New South Wales.

Holotype, ♂, Narara, November 3, 1921 (*A. Tonnoir*).

Paratopotypes, 2 ♂ ♂.

Limnophila lepida is closely related to *L. ocellata*, Skuse, and with this latter species constitutes a distinct group of the genus that is characterized by the presence and position of the tuberculate pits which are placed far back on the præscutum, in transverse alignment with the pseudosutural foveæ. The present species is readily told by the sparse non-ocellate wing-pattern.

Limnophila subtristis, sp. n.

General coloration brown; antennæ short; legs dark brown to black, the femoral bases narrowly paler; wings with a strong brown suffusion, the stigma darker; no macrotrichiæ in cells of wings; Sc_2 at tip of Sc_1 ; cell M_1 lacking; male hypopygium with the outer dististyle extended into a simple slender chitinized point.

Male.—Length about 4.5 mm.; wing 6.2 mm.

Rostrum and palpi brownish black. Antennæ short, if bent backward not extending beyond the pronotum, black throughout; basal flagellar segments subcylindrical to oval, crowded, the outer segments more elongate, with verticils that are longer than the segments. Head light grey, the centre of the vertex somewhat darker.

Pronotum pruinose. Mesonotal præscutum brown, without stripes, the surface very sparsely pruinose, especially laterally; tuberculate pits lacking; scutellum and postnotum

more pruinose. Pleura dark, grey pruinose. Halteres pale, the knobs weakly infuscated. Legs with the coxæ and trochanters brownish testaceous; femora dark brown, the bases paler; tibiæ and tarsi black. Wings with a strong brown suffusion, the oval stigma darker brown; veins darker brown. No macrotrichiæ in cells of wing. Venation: Sc_1 ending shortly before the fork of the long R_s , Sc_2 at its tip; R_s angulated at origin; R_2 subequal to R_{1+2} and more than twice R_{2+3} ; R_{2+3+4} shorter than $m-cu$; cell M_1 lacking; $m-cu$ before or close to mid-length of cell 1st M_2 ; veins beyond the cord elongate; anterior arculus present.

Abdomen dark brown, the ninth segment more yellow, the styli weakly infuscated. Male hypopygium with the basistyles relatively long and slender, strongly setiferous. Outer dististyle elongate, near mid-length somewhat dilated and provided with long conspicuous setæ, thence prolonged into a slender, curved, simple apex, the extreme tip decurved. Inner dististyle fleshy, setiferous to apex. Gonapophyses with a comb of about nine chitinated teeth or spines. *Ædeagus* short or of moderate length only. Ninth tergite with a U-shaped notch, the margins with microscopic setulæ, the lobes thus formed obtuse.

Hab. New South Wales.

Holotype, ♂, Narara, November 3, 1921 (*A. Tonnoir*).

Paratopotypes, 2 ♂♂.

Limnophila subtristis is allied to *L. levidensis*, Skuse, and *L. luctuosa*, Skuse, differing in the coloration and the position of Sc_2 .

Limnophila intonsa, sp. n.

General coloration grey, the præscutum with three brown stripes; antennæ short; wings with a yellow tinge, spotted with brown, the apices of cells R_4 and R_5 largely clear; R_2 about one-half R_{1+2} ; male hypopygium with the outer dististyle strongly swollen near mid-length, the outer face set with long wavy setæ.

Male.—Length 6–6.3 mm.; wing 6.6–7.5 mm.

Female.—Length 7–8 mm.; wing 7.3–8 mm.

Rostrum and palpi dark brown. Antennæ short, if bent backward not extending beyond the pronotum; basal segments light brown, the flagellum dark brown, the verticils longer than the segments. Head yellowish grey, the anterior vertex broad, more silvery, with a brown spot at the narrowest point.

Pronotum yellowish brown. Mesonotal præscutum grey to yellowish grey with three darker stripes; pseudosutural foveæ shiny black, conspicuous; no tuberculate pits; scutum yellowish brown, the centres of the lobes darker brown; scutellum and postnotum with a yellowish-grey pollen. Pleura dark brown, pruinose; some specimens with a paler longitudinal stripe on dorsal region of sternopleurite. Halteres pale, the knobs more yellowish. Legs with the coxæ obscure yellow, the middle coxæ sparsely pruinose; trochanters obscure yellow; femora obscure yellow, the tips narrowly infuscated; tibiæ obscure yellow, the tips narrowly infuscated; tarsi brownish black, the proximal ends of the basitarsi sometimes paler. Wings with a yellow tinge, cells *C* and *Sc* faintly infuscated except at tips; a handsome dark brown pattern, distributed as follows: postarcular in bases of cells *R* and *M*; at origin of *Rs*; a small spot near two-thirds the length of *Rs*; stigma oval, dark brown, connected with a seam on the anterior cord; a large spot in outer end of cell *R*₃; a seam at fork of *M*₁₊₂, this more or less expanded over the surrounding veins; seams at outer end of cell 1st *M*₂, the posterior cord, the outer section of *Cu*₁, and tip of vein 2nd *A*; anal margin of wing slightly darkened; veins brownish yellow, darker in the infuscated areas. No macrotrichia in cells of wing. Venation: *Sc*₂ at extreme tip of *Sc*₁, the latter ending opposite or beyond the fork of *Rs*, the latter elongate, strongly arcuated at origin; *R*₂ about one-half *R*₁₊₂, and a little more than one-half *R*₂₊₃; cell *M*₁ about one-half its petiole; *m-cu* its own length or more beyond the fork of *M*; anterior arcus present.

Abdomen dark brown, sparsely pruinose; hypopygium dark. Male hypopygium with the basistyles relatively stout. Outer dististyle chitinized, the outer margin near mid-length extensively and strongly tumid and here set with abundant tubercles that bear very long wavy setæ; inner dististyle shorter, pale basally, with conspicuous setæ, the apical third narrowed, infuscated, the apex with a strong seta and smaller setiferous punctures. Gonapophyses with three curved hooks directed mesad. Ædeagus short. Ovipositor with the valves long and slender, acute, the tergal valves horn-coloured, gently upcurved; sternal valves nearly straight, black; dorsal basal shield infuscated.

Hab. Tasmania.

Holotype, ♂, Burnie, October 26, 1922 (*A. Tonnoir*).

Allotype, ♀, Wilmot, January 8, 1923 (*A. Tonnoir*).

Paratopotype, ♂, February 1, 1923; *paratypes*, ♀, Geestou, December 7, 1922; ♀, St. Patrick River, October 30, 1922; ♂, with the allotype; ♀, Strahan, February 1924 (*G. H. Hardy*), in the University of Queensland Collection.

Limnophila serena, sp. n.

General coloration grey; antennæ short; halteres pale, the knobs yellowish; legs yellow, the terminal segments darkened; wings whitish subhyaline with a heavy brown pattern, the apex solidly darkened; both Sc_1 and Sc_2 beyond the fork of R_s ; R_2 a little more than one-half R_{1+2} ; cell M_1 present; male hypopygium with the outer dististyle clavate, the apex a simple spine, the style provided with relatively short setæ.

Male.—Length 7.5–9 mm.; wing 8–9.8 mm.

Female.—Length 10.5 mm.; wing 10 mm.

Rostrum and palpi dark brown, the former sparsely pruinose. Antennæ relatively short, if bent backward extending to about mid-distance between the pronotum and wing-root, brown, the terminal segments passing into dark brown; flagellar segments gradually decreasing in size to the apex, the verticils a trifle longer than the segments. Head brownish grey, the anterior vertex light grey, the centre with a dusky spot.

Pronotum dark grey. Mesonotal præscutum dark grey with a median brown vitta; tuberculate pits lacking; pseudo-sutural foveæ black; scutum and scutellum dark grey with a narrow brown median line; postnotum grey. Pleura grey, the dorso-pleural region buffy brown. Halteres pale, the knobs yellowish. Legs with the coxæ brownish yellow, the bases a little darker; trochanters yellow; femora and tibiæ yellow; three basal tarsal segments brownish yellow, the tips narrowly blackened; terminal tarsal segments black. Wings whitish subhyaline; cells C and Sc brownish yellow, both ends clearer; a heavy brown pattern distributed as follows:—postarcular in cells R , M , and Cu ; origin of R_s , this not attaining vein M ; stigmal blotch slightly darker brown, oval, connected with a continuous brown seam along the cord to the anal margin; outer end of cell 1st M_2 seamed with brown; wing-apex broadly infumed, this including the outer ends of cells R_2 , R_3 , R_4 , R_5 , 2nd M_2 , and M_3 , and all of cell M_1 ; a spot at end of vein 2nd A , opposite the origin of R_s ; a tiny spot at end of vein M_4 ; veins pale yellow, darker in the infuscated areas. No macrotrichia in cells of wing. Venation: Sc_2 at tip of Sc_1 , both ending

shortly beyond the fork of R_s ; R_s long, strongly arcuated at origin; R_2 oblique, a little more than one-half R_{1+2} and subequal to R_{2+3} ; R_{2+3+4} a little shorter than $m-cu$; cell M_1 a little more than one-half its petiole; cell 1st M_2 small, m longer than the outer deflection of M_3 ; $m-cu$ less than its length beyond the fork of M ; anterior arculus present.

Abdomen dark brown, the basal sternites paler; hypopygium brownish yellow. Male hypopygium with the basistyles relatively stout, the outer face with conspicuous scattered setæ, the mesal face with more abundant smaller erect setæ. Dististyles two, closely connected basally by membrane; outer dististyle longer, blackened, clavate, gently dilated outwardly, the extreme tip suddenly narrowed into an acute spine; style with numerous relatively short setæ. Inner dististyle shorter, broad and fleshy at base, the apex narrowed and feebly chitinized, terminating in one or two larger and several microscopic setæ. Gonapophyses a chitinized plate armed with about five hook-like spines that are directed mesad. Ædeagus relatively short. Ninth tergite with a very broad, gentle emargination, the lateral lobes formed obtuse.

In the female, the sternites are more extensively obscure yellow. Ovipositor with the valves long and slender, the tergal valves gently upcurved, the sternal valves more infuscated.

Hab. Tasmania.

Holotype, ♂, Mt. Wellington, December 2, 1922 (*A. Tonnoir*).

Allotopotype, ♀, January 1924 (*G. H. Hardy*), in the University of Queensland Collection.

Paratype, ♂, Burnie, January 31, 1923 (*A. Tonnoir*).

Linnophila casta, sp. n.

General coloration dark brown, the sides of the præscutum paler; legs with conspicuous suberect setæ; wings with a faint greyish tinge; veins R_{2+3+4} and the combined R_{2+3} and R_3 nearly equal in length, cell R_3 thus being short and widened at margin; cell M_1 present; male hypopygium with the outer margin at apex microscopically serrulate.

Male.—Length about 4.5 mm.; wing 6 mm.

Rostrum and palpi dark brown. Antennæ small, if bent backward not attaining the wing-root, dark brown throughout; flagellar segments cylindrical or truncated fusiform, becoming smaller outwardly. Head dark brown, sparsely pollinose.

Pronotum dark brown. Mesonotal præscutum restrictedly dark brown medially, the sides broadly paler brown, the humeral region yellowish brown; tuberculate pits shiny, elongate, placed at near mid-distance between the level of the pseudosutural foveæ and the cephalic margin of the præscutum; foveæ relatively small and elongate, dark reddish brown, placed transversely; scutum light brown; scutellum and postnotum darker brown. Pleura dark brown, the dorso-pleural membrane and the ventral portion of the sternopleurite more brownish yellow. Halteres elongate, pale, the knobs weakly infuscated. Legs with the coxæ and trochanters yellowish testaceous; femora and tibiæ pale brown, the terminal tarsal segments passing into darker; segments of legs elongate, with conspicuous suberect setæ; tibial spurs small but distinct; claws long and slender. Wings with a faint greyish tinge, the stigma barely evident; veins pale brown. No macrotrichia on veins of basal half of wing except on R where they extend slightly basad of the origin of R_s . Venation: Sc relatively short, Sc_1 ending shortly before the fork of R_s , Sc_2 not far from its tip; R_s long, arcuated at origin; R_2 subequal to R_{1+2} and approximately twice as long as R_{2+3} or a trifle less; R_{2+3+4} elongate, subequal to or a little shorter than the combined R_{2+3} and R_3 , this latter series of veins one-half to two-thirds as long as R_4 , the veins strongly divergent, cell R_3 at margin being nearly twice as wide as cell R_2 ; $r-m$ long, arcuated; cell M_1 from one-third to two-thirds its petiole; cell 1st M_2 relatively small, widened outwardly; $m-cu$ a little less than to fully its own length beyond the fork of M ; anterior arculus present.

Abdomen dark brown, the hypopygium a trifle more reddish brown. Male hypopygium with the basistyles relatively stout, narrowed outwardly. Outer dististyle entirely chitinated and blackened, a straight rod, gently widened at apex, the outer apical angle produced into a short curved hook, the outer margin of style on distal third with microscopic appressed serrulations. Gonapophyses with the base enlarged, the caudal angle produced into a very long recurved spine that is nearly straight. *Ædeagus* short and broad.

Hab. Victoria.

Holotype, ♂, Millgrove, May 30, 1925 (*F. E. Wilson*).

Paratopotype, ♂.

Type in the collection of the National Museum, Victoria.

Limnophila morosa, sp. n.

Size small (wing, ♂, about 4.2 mm.); general coloration

brownish grey; antennæ short, the flagellar segments oval to cylindrical; wings tinged with brown, the stigma a little darker; Sc_1 long; R_{2+3+4} longer than $m-cu$; R_{2+3} a little more than one-half R_3 ; cell M_1 lacking; no macrotrichia in cells of wing.

Male.—Length about 3 mm.; wing 4–4.2 mm.

Rostrum and palpi brown. Antennæ brownish black throughout, short, if bent backward not reaching the wing-root; basal flagellar segments oval, becoming cylindrical and finally elongate-cylindrical at tip; verticils a little shorter than the segments. Head broad, greyish brown.

Mesonotum brownish grey with a sparse yellow bloom; pseudosutural foveæ lying longitudinally with the axis of the body, comma-shaped, not far from the margin of the sclerite. Pleura light grey pruinose. Halteres pale. Legs with the coxæ elongate, light grey pruinose; trochanters brownish yellow; remainder of legs dark brown, the femoral bases narrowly paler, the tarsi still darker. Wings with a strong brownish tinge, the stigma subcircular, only a trifle darker than the ground-colour and very ill-defined; veins darker brown. Venation: Sc_1 ending shortly beyond the fork of Rs , Sc_2 some distance from its tip, Sc_1 alone being longer than $m-cu$; Rs in alignment with R_{2+3+4} , the latter longer than $m-cu$; veins R_3 and R_4 relatively short, divergent; R_4 in alignment with R_{2+3+4} ; R_2 subequal to R_{1+2} ; R_{2+3} a little more than one-half R_3 ; inner ends of cells R_4 , R_5 , and 1st M_2 in transverse alignment; cell M_1 lacking; cell 1st M_2 long and narrow; normally the three veins issuing from the cell are equidistant at origin, but in the paratype M_{1+2} and M_3 are approximated or even united for a short distance at base—in this case, the outer deflection of M_3 thus including the whole outer end of the cell; $m-cu$ shortly before to beyond mid-length of cell 1st M_2 .

Abdomen dark greyish brown, the hypopygium slightly more brownish. Male hypopygium with the basistyles simple, relatively stout. Dististyles two, terminal in position, the outer relatively short, stout, blackened, narrowed to the bifid apex; outer tooth a little more slender than the inner or apical tooth; surface of style with conspicuous erect setæ. Inner dististyle a little shorter, narrowed gradually to the obtuse apex; a little more than the basal half with conspicuous setæ, these mostly short or of moderate length; subapical portion nearly glabrous, the apex with numerous microscopic setulæ. Gonapophyses appearing as strongly curved hooks, in slide-preparations with the long

apex directed laterad and cephalad, the apex longer than the enlarged basal portion. *Ædeagus* relatively short and stout.

Hab. Tasmania.

Holotype, ♂, Cradle Valley, January 10, 1923 (*A. Tonnoir*).

Paratopotype, ♂, January 27, 1923 (*A. Tonnoir*).

Gynoplistia (Paralimnophila) bicincta, sp. n.

General coloration grey, the *præscutum* with eight dark lines; antennæ 16-segmented, in the male with nine branched segments, the branches short; femora and tibiæ each with a pale ring; wing-pattern relatively heavy; hypopygium dark.

Male.—Length about 10–10·2 mm.; wing 10·2–10·5 mm.

Female.—Length about 12 mm.; wing 10·5 mm.

Rostrum dark brown, sparsely pruinose; palpi brownish black. Antennæ 16-segmented, the branches relatively short, the formula (♂) being 2+9+5; first flagellar segment with a branch that is nearly twice the segment; branches gradually increasing in length to the fourth and fifth flagellar segments where they are about two and one-half times the segment, thence gradually decreasing in length, the last branch shorter than the segment; unbranched terminal segments gradually decreasing in length to the last; basal segment of scape infuscated above, pruinose; second segment obscure brownish yellow; basal flagellar segment obscure yellowish brown; remaining segments and all branches black. Head grey, the centre darker, the anterior vertex paler.

Mesonotal *præscutum* grey with four darker greyish-brown stripes, the intermediate pair longest, narrow and confluent behind, separated from one another by a capillary vitta only; lateral stripes short; interspaces and a short sublateral stripe darker velvety-brown than the usual stripes, subequal in length to the lateral stripes, the *præscutum* thus appearing to have eight stripes; pseudosutural foveæ very large and conspicuous, circular, blackened; scutum dark grey, each lobe with two darker markings; scutellum and postnotum dark grey. Pleura light grey, the dorso-pleural membrane obscure yellow; sternopleurite and base of fore coxæ with a paler longitudinal area. Halteres yellow, the knobs dark brown. Legs with the coxæ grey, the fore coxæ small, brownish grey; trochanters obscure yellow; femora with the bases broadly yellow, narrowest on the fore legs, broadest (about the basal third) on the hind legs; remainder of

femora black with a narrow but conspicuous yellow ring about twice its length before the tip; tibiæ brownish black with an obscure yellow ring a little more than its own length beyond the base; tarsal segments light brown, the incisures darker, the terminal two segments uniformly dark brown. Wings whitish subhyaline, extensively spotted and washed with darker; cells *C* and *Sc* light brown; the dark brown spots include quadrate areas at one-third the length of cell *R*, origin of *Rs*; the oval stigma; seams on anterior cord; outer end of cell 1st *M*₂ and a spot at end of vein *R*₃; somewhat paler brown washes occupy the wing-apex, outer two-thirds of cell *M*, cell *M*₄, the cord, apices of cells 1st *A* and 2nd *A*, and bases of cells *Cu* and 2nd *A*; a circular pale droplet in the outer end of cell *R*₃; veins dark brown, paler in the hyaline areas. Venation: *Sc*₁ ending about opposite the fork of *Rs*, *Sc*₂ some distance from its tip; veins *R*₃ and *R*₄ long, very gently divergent at base, more abruptly so towards their tips; cell *M*₁ about twice its petiole; *m-cu* about one-half or more of its length beyond the fork of *M*.

Abdomen dark brown, dark grey pruinose; hypopygium dark. Male hypopygium with the outer dististyle heavily blackened, broadly expanded at tip, the apex with a rounded notch to give a bilobed appearance to the end of the style, the outer arm being an acute black spine, the inner arm a stouter lobe that is obtuse at apex; inner dististyle broad and flattened.

The female is generally similar to the male; antennæ 16-segmented, with the basal flagellar segments only slightly produced on lower face beyond mid-length. Pseudosutural foveæ more reddish. Tibial band paler, more whitish, than the femoral ring.

Hab. Tasmania.

Holotype, ♂, Cradle Valley, January 12, 1923 (*A. Tonnoir*).

Allotype, ♀, Geeveston, December 8, 1922 (*A. Tonnoir*).

Paratopotypes, 2 ♂♂, January 10-12, 1923 (*A. Tonnoir*).

Gynoplistia (Paralimnophila) uncinata, sp. n.

General coloration grey, the præscutum with four dark brown stripes; antennæ (♂) more than one-half the length of the body, with long branches; tibiæ with an obscure yellow subbasal ring; wings creamy-white with a heavy brown pattern.

Male.—Length 12-13 mm.; wing 12-13 mm.; antennæ about 7-7.5 mm.

Rostrum grey pruinose, the apex tufted with a few long yellow setæ; palpi black. Antennæ 17-segmented, the formula being $2+14+1$ or $2+13+2$; elongate, with conspicuous branches, if bent backward extending to about one-third the length of the abdomen, black throughout; longest branches about three times the segments. Head dark, light grey pruinose.

Pronotum light grey pruinose. Mesonotal præscutum grey with four dark brown stripes, the narrow intermediate pair separated by a broad line of the ground-colour; extreme lateral margins of the notum at the suture darkened; posterior interspaces more or less suffused with darker; pseudosutural foveæ large, oval; light reddish to nearly black; scutum dark grey, each lobe with two dark markings; remainder of mesonotum grey. Pleura dark with a heavy light grey pruinosity, the ventral sternopleurite darker. Halteres yellow, the knobs brownish black. Legs with the coxæ brown, light grey pruinose; trochanters obscure yellow; femora brownish black, the basal fourth or fifth obscure yellow; tibiæ black with an obscure yellow subbasal ring placed about its own length or less beyond the base; the paratype has the rings much broader and more distinct, especially on the posterior legs; tarsi black, the posterior tarsi paler, their vestiture consisting of yellow setæ, the last segment black. Wings creamy-white with a very heavy brown pattern; base of wing light yellow, cells *C* and *Sc* light brown; the brown markings are arranged generally as four interrupted cross-bands, all but the last being connected by a broad longitudinal wash in cells *R* and *M*; the basal band includes the bases of cells *R* and *M* and the outer half of cell 2nd *A*, broadly interrupted in cell 1st *A*; the second band includes a circular or rectangular area at origin of *Rs* and the outer end of cell 1st *A*, the band being nearly continuous by the wash in cells *M* and *Cu*, interrupted only as a slight line in cell *R*; a broad complete band at the cord, the oval stigma darker brown, this band including a pale spot before the stigma and a circular spot in cell 1st *M*₂; the fourth band includes the wing-tip, except the apex of cell *R*₃, but including all of cell *M*₁; veins yellow, dark brown in the infuscated areas. Venation: *R*₂₊₃₊₄ very short; cell *R*₃ deep; veins *R*₃ and *R*₄ parallel except at their outer ends; cell *M*₁ deep; *m-cu* at mid-length of cell 1st *M*₂.

Abdominal tergites dark brown, sparsely pruinose; sternites paler brown, each segment with three darker markings, the median stripe more nearly entire behind, light grey

pruinose; hypopygium reddish brown, the tergite darker medially, the caudal margin produced.

Hab. Tasmania.

Holotype, ♂, Hartz Mts., December 10, 1922 (*A. Tonnoir*).

Paratopotype, ♂; *paratype*, ♂, Mt. Wellington, November 25, 1922 (*A. Tonnoir*).

Gynoplistia (Paralimmophila) decincta, sp. n.

Antennæ 16-segmented, the male with nine branched segments, the branches relatively short and inconspicuous; femora and tibiæ without pale annuli.

Male.—Length about 9.5 mm.; wing 9.5 mm.

Rostrum grey; palpi black. Antennæ 16-segmented, the formula being 2+9+5; branches relatively short and inconspicuous, the longest (flagellar segments 4 and 5) scarcely twice as long as the segment; antennæ short, if bent backward not attaining the wing-root, black throughout, the basal segment weakly pruinose. Head dark grey, the anterior vertex and the orbits lighter grey.

Pronotum grey. Mesonotal præscutum light grey, the posterior half more suffused with light brown, the three usual stripes dark brown, the median stripe divided by a paler brown line; scutum light grey, the lobes largely brown; scutellum and postnotum dark, light grey pruinose. Pleura dark, heavily grey pruinose; dorso-pleural membrane restrictedly obscure yellow. Halteres yellow, the knobs dark brown. Legs with the coxæ dark, grey pruinose; trochanters obscure brownish yellow, the posterior trochanters slightly pruinose; femora black with about the basal fourth obscure yellow; tibiæ brown, the tips passing into brownish black; tarsi brownish black. Wings whitish subhyaline, spotted and longitudinally washed with darker; cell *C* brown; cell *Sc* largely yellow; stigma oval, darker brown; sparse brown markings at arculus; origin of *Rs*; along cord; ends of veins *R*₃ and *R*₄; the brown washes are paler, but very extensive, including most of the posterior half of the wing except the basal two-thirds of cell 1st *A*, the basal third of cell 2nd *A*, and almost the apical fourth of cell *Cu*; veins brown, more yellowish in the pale areas. Venation: *Rs* relatively short, angulated and weakly spurred at origin; cell *M*₁ deep, more than twice its petiole; *m-cu* about one-third its length beyond the fork of *M*.

Abdomen dark brown, the sternites more pruinose; hypopygium slightly more reddish brown. Male hypopygium

with the outer dististyle relatively small and slender, curved, the apical two-thirds blackened, the outer apical angle further produced into a chitinized point. Gonapophyses appearing as very slender, acicular, gently curved horns.

Hab. Tasmania.

Holotype, ♂, Zeehan, February 1924 (*G. H. Hardy*).

Paratopotype, ♂.

Type in the collection of the University of Queensland.

Gynoplistia (Paralimnophila) decincta breviramus, subsp. n.

Male.—Length about 10 mm.; wing 10.5–10.6 mm.

Agreeing closely with the typical form, differing especially in antennal structure.

Antennæ only 15-segmented, the formula being 2+8+5; branch of the first flagellar segment a little longer than the segment; longest branches (flagellar segments 3 and 4) only about one-half longer than the segments that bear them; from this point outward the branches decrease in length, that of flagellar segment 7 being about two-thirds the length of the segment; that of flagellar segment 8 reduced to a stout subapical protuberance that is slightly variable in length. Wings with the brown pattern darker and more extensive, including a series of about seven brown spots in the radial field that are represented only by pale washes in the typical form. Venation: R_2 approximately twice R_{1+2} ; R_{2+3} about one-half R_3 alone; cell 1st M_2 larger, with *m-cu* close to its inner end; *m* much shorter than the outer deflection of M_3 .

Hab. Tasmania.

Holotype, ♂, Mt. Field, December 18, 1922 (*A. Tonnoir*).

Paratopotype, ♂.

Gynoplistia (Paralimnophila) setulicornis, sp. n.

General coloration grey, the præscutum with three brown stripes; antennæ 16-segmented, in the male with long slender branches, the entire flagellum with sparse coarse setæ; tarsi with central portions yellow; wings narrow, the costal region dark brown, the disk with a sparse brown pattern; male hypopygium with the outer lateral angle of the outer dististyle terminating in a curved hook.

Male.—Length about 10 mm.; wing 8.2 mm.; antenna about 4.5 mm.

Rostrum light grey; palpi dark brown. Antennæ with the scapal segments dusted with grey; flagellum black throughout; antennæ elongate, with long conspicuous branches, the

longest about three times as long as the segment ; antennæ 16-segmented, the formula being $2+12+2$; branch of the first segment a little less than twice the length of the segment ; last branch about two-thirds the segment ; segments and branches with long, sparse, relatively coarse setæ that are fully twice as long as the diameter of the branches. Head clear light grey, the centre of the vertex suffused with brown. Anterior vertex wide.

Pronotum light grey. Mesonotal præscutum light grey with three brown stripes, the median stripe narrowed behind and reaching the suture ; pseudosutural foveæ large, black ; scutal lobes grey, the centre of each brown ; scutellum and postnotum light grey, the median line of the former narrowly light brown. Pleura light grey, the propleura and anepisternum somewhat darker. Halteres pale, the knobs infuscated. Legs with the coxæ pale brown, their inner faces yellow, the outer surface sparsely pruinose ; trochanters obscure yellow ; femora black, only the narrow bases obscure yellow, more broadly so on the fore femora where about the basal fourth is included ; tibiæ black ; basitarsi black, the tips narrowly yellowish ; tarsal segments 2 and 3 and the base of segment 4 obscure yellow ; remainder of tarsi black. Wings narrow, whitish subhyaline ; cells *C* and *Sc* dark brown ; stigma oval, dark brown ; very small brown spots at origin of *Rs*, beyond mid-length of the distance between arculus and origin of *Rs* on *R*, tip of R_{1+2} ; very narrow seams along cord, outer end of cell 1st M_2 , fork of M_{1+2} , and at the margins ; veins dark brown. Venation : *Rs* angulated and spurred at origin ; R_{2+3} approximately equal to R_{1+2} ; *m* short.

Abdominal tergites dark brown, sparsely pruinose ; sternites obscure yellow, darker outwardly ; hypopygium black. Male hypopygium with the tergal region relatively broad, the apex truncated. Basistyles relatively stout, the setæ sparse. Outer dististyle blackened, a gently curved flattened blade, slightly dilated at apex, the outer apical angle a short curved hook, the inner apical angle evenly rounded ; surface of style smooth. Inner dististyle approximately equal in length, stout, the outer margin narrowly chitinized, the base of the style with coarse setæ, the apex with smaller setulæ ; a basal raised portion densely set with a cushion of microscopic setulæ. Gonapophyses appearing roughly lyriform, each a flattened blade that is narrowed to the acute tip, the outer margin densely fringed with setæ, the inner margin smooth.

Hab. New South Wales.

Holotype, ♂, Mt. Kosciusco, November 24, 1921 (*R. J. Tillyard*).

The present species is allied to *G. (P.) punctipennis*, Westwood, differing, among other characters, in the coloration of the legs.

Gynoplistia (Paralimnophila) incompta, sp. n.

General coloration grey, the præscutum with seven brown stripes; a continuous brown median line from the scutum to the postnotum; wings with a strong brownish-yellow tinge, the dark pattern very sparse; veins R_3 and R_4 strongly divergent, cell R_3 at margin very wide; $m-cu$ at or shortly before the fork of M .

Male.—Length about 7 mm.; wing 8.8 mm.

Rostrum and palpi brownish black, the former somewhat shiny. Antennæ with the basal segment dark, dusted with grey; second segment brown; flagellum broken. Head grey; centre of the vertex with a longitudinal dusky line.

Pronotum dark, sparsely pruinose. Mesonotal præscutum grey, with three brown stripes, the median stripe strongly narrowed behind, the interspaces with a slightly paler brown vitta, the sublateral regions of the præscutum behind the pseudosutural foveæ similarly darkened, the whole giving to the præscutum the appearance of having seven stripes which are alternately dark and paler brown; pseudosutural foveæ oval, blackened; scutum dark grey, each lobe with a linear oblique line that is a caudal prolongation of the lateral præscutal stripes; median line of scutum with a capillary dark brown vitta that extends caudad across the scutellum and postnotum; scutellum and postnotum brown, heavily dusted with grey, the lateral margins of the mediotergite and the mesal half of the pleurotergite darker. Pleura grey, the sternopleurite variegated with pale brown; dorso-pleural membrane dark. Halteres brown, the base of the stem narrowly obscure yellow. Legs with the fore coxæ dark, the other coxæ more reddish brown, sparsely dusted with grey; trochanters obscure brownish yellow; femora obscure yellow, the apices passing into pale brown; tibiæ obscure yellow, the tips narrowly infuscated; basal tarsal segments brownish testaceous, the tips of the segments narrowly darkened; terminal tarsal segments entirely darkened. Wings with a strong brownish-yellow tinge, the base and costal region somewhat darker; stigma oval, darker brown; very vague and barely indicated clouds at origin of R_s , along cord and outer end of cell 1st M_2 , and fork of M_{1+2} ; veins brown. Venation: Sc relatively short, Sc_1 ending shortly

before the end of *Rs*, *Sc*₂ close to its tip; *Rs* elongate, angulated at origin; *R*₂₊₃₊₄ short and straight; *R*₂ one-half or less *R*₁₊₂ and about one-half *R*₂₊₃; veins *R*₃ and *R*₄ diverging, cell *R*₃ at margin being very wide; basal section of *R*₅ arcuated; cell *M*₁ more than twice its petiole; cell 1st *M*₂ rectangular, slightly widened outwardly; *m-cu* at or shortly before the fork of *M*; anterior arculus present.

Abdomen dark brown. Male hypopygium with the outer dististyle much as in *G. (P.) setulicornis*, sp. n., the apex dilated, the outer apical angle produced into an acute spine, the inner apical angle evenly rounded.

Hab. New South Wales.

Holotype, ♂, Sydney, September 21, 1921 (*G. H. Hardy*).

Type preserved in the collection of the writer.

Despite the lack of antennæ and the general appearance, which is very much like a *Limnophila*, I believe the present species to be correctly placed as above, because of the venation, notably the shortness of *Sc* and the position of *m-cu*, and the structure of the male hypopygium.

XX.—*Fulgorides* nouveaux provenant de la Collection du British Museum. Par le Dr. V. LALLEMAND.

[Sous-famille *FULGORINÆ*.

Tribu *APHANARINI*.

NOVODICTYA, gen. nov.

Front irrégulier, à larges fossettes, une sous la carène transversale, une de chaque côté, près du bord; sur la partie médiane, sous la fossette supérieure, le front se bombe légèrement en un talu longitudinal bordé de chaque côté par un assez large sillon. Surface du vertex fort concave, à bords saillants; lobe latéral portant les yeux, relativement assez gros. Tronc commun des deux nervures du clavus, au lieu de se prolonger en arrière, se terminant dans le bord interne; partie apicale réticulée du corium remontant à peu près jusqu'au milieu de l'élytre. Trois épines sur les tibias postérieurs. Rostre s'étendant entre les hanches postérieures. Voisin des genres *Pseudodictya* et *Ruhlella*, Schmidt, par la surface du front non unie, s'en distingue aisément par le tronc commun des deux nervures du clavus se terminant dans le bord interne.

Type du genre, *N. punctata*, Lallemand.

(1) *Novodictya punctata*, sp. n.

Tête, pronotum d'un jaune très légèrement brunâtre, brillants;

sont noirs; sur le front, la carène transversale, une bande transversale médiane, ayant sur le milieu une pointe dirigée vers le bord supérieur, à chacune de ses extrémités, le long du bord externe, une bande longitudinale se prolongeant jusqu'au bord postérieur du vertex, enfin, dans chacun des deux sillons longitudinaux situés au-dessus du clypeus, un triangle; sur le vertex, trois lignes longitudinales, dont la médiane s'étend jusqu'à la carène transversale du front; sur le pronotum, trois bandes longitudinales, une médiane plus large, se bifurquant au bord antérieur et enclavant ainsi une petite tache jaune et deux latérales. Clypeus noir, brillant. Écusson noir, brillant, ayant deux taches jaunes. Sur les élytres longs de 18 mm., les 8 premiers mm. et la partie externe au radius, sur une longueur de 14 mm., sont ocre-jaune clair; partie apicale noire, à bord antérieur oblique du radius vers l'extrémité du clavus; sur la partie basale jaune, le tronc basal des nervures, cinq taches sur le corium et quelquefois une sur la nervure externe du clavus sont noirs, les cinq taches du corium sont disposées comme suit: trois sur le cubitus, dont la plus petite à sa base et deux sur la partie externe au radius. Ailes d'un blanc-laiteux, largement bordées de brun-noir et à nervures brunes. Abdomen noir, ses bords latéraux ainsi que le bord postérieur du dernier segment à la face inférieure, et les organes génitaux sont rouge-carmin. Sternum noir à taches jaunes; hanches postérieures jaunes; pattes noires, articulations fémoro-tibiales et une tache vers l'extrémité des tibias rouges.

Hab. Cameroun, Buar, v. 1914.

Longueur du corps 15 mm.

Elytres: longueur 18 mm., largeur 5.5 mm, étendus 42 mm.

(2) *Eddara costalis*, sp. n.

Tête, pronotum, écusson, sternum ocre légèrement brunâtre, milieu de l'écusson un peu plus foncé. Elytres d'un orange légèrement rougeâtre, à extrémité brun-noirâtre; ailes à base rosée, derrière celle-ci une petite partie d'un blanc plus ou moins orange et tout le restant brun. Face supérieure de l'abdomen rougeâtre, sauf la base des deux premiers segments qui est noire; face inférieure à segments noirs bordés postérieurement de rouge-orange et rougeâtres sur les côtés. Organes génitaux rougeâtres. Hanches noires. Rostre, pattes ocre-brun.

Front bombé; rostre s'étendant entre les hanches postérieures; trois épines sur les tibias postérieurs.

Longueur totale 16 mm.

Longueur du corps 10 mm.

Elytres étendus 31 mm.

Hab. Gold Coast, Accra, iii. 1921 (*Dr. W. J. Scott Macfie*).

(3) *Metaphæna abyssinica*, sp. n.

Tête, prothorax, méso- et métasternum, abdomen rouges ou ocre plus ou moins rougeâtre, le front est toujours plus foncé. Sur le

pronotum, quatre taches noires dont les deux médianes sont les plus grandes. Ecusson noir. Elytres longs de 21 mm., les 12 premiers mm. sont noirs, les derniers ocre-brun; sur la partie noire dans l'espace compris entre le radius et le bord externe se voient des taches rouges, une bordure postérieure à cette partie noire, s'étendant plus ou moins loin vers l'intérieur, est également rouge. Ailes rouges, partie apicale et une bordure s'étendant jusqu'à la région anale, brunes; sur la partie rouge, un tache près de la base et six autres, un peu plus en arrière (dont trois grosses et trois petites) brunes. Sur les côtés des segments abdominaux des taches blanchâtres. Rostre, pattes noirs.

Surface du front plus longue que large, aplatie, ayant deux carènes latérales, assez peu saillantes; rostre s'étendant jusqu'au devant des organes génitaux. Le prolongement du front sur le vertex est très petit. Cette espèce pourrait être mise dans le genre *Malfeytia* à cause de la longueur du rostre et des taches sur les élytres, mais s'en différencie par son prolongement frontal.

Longueur totale 25 mm.

Longueur du corps 17 mm.

Elytres: longueur 21 mm., largeur 8 mm., étendus 48 mm.

Hab. Abyssinie, Harar (ma collection), Lake Zwai, v. 1914 (O. Kovacs) (Collection du British Museum).

(4) *Holodictya incarnata*, sp. n.

Vertex, pronotum, écusson rouge-brunâtre; front, clypeus, abdomen, pattes, partie basale des élytres rouge-grenat; élytres recouvertes d'une poussière blanchâtre, à nervures jaunâtres et partie apicale brune, plus claire par places (vus par transparence), au devant de celle-ci, dans les dernières cellules de la partie basale rouge, des taches brunes. Champ basal des ailes assez grand, rouge, partie apicale largement noire, région anale d'un blanc-laiteux, les nervures brun-rouge dans la partie antérieure, deviennent concolores près du bord postérieur. A la face supérieure de l'abdomen, les segments sont bordés de blanc-jaunâtre en arrière et sur les côtés, et seulement sur les côtés à la face inférieure; la plus grande partie de l'abdomen, surtout à la face supérieure est recouverte d'une matière blanche, cireuse; extrémité des épines et griffes brunes.

Front un peu plus large que long, sans carène; rostre dépassant les hanches postérieures; élytres élargis en arrière à réseau apical dense; quatre épines sur les tibias postérieurs.

Longueur du corps 20 mm.

Elytres: longueur 20 mm., largeur 7 mm., étendus 43 mm.

Hab. W. of Kambove (150-200 miles) (3500-4500 ft.).

(5) *Desudaba meridionalis*, sp. n.

Tête, pronotum et écusson brun clair, côtés de ce dernier noirs; rostre ocre-brun; sur le clypeus une ligne longitudinale et des stries obliques ocre-brun clair; sternum jaune-brun plus foncé par

places; abdomen ocre-jaune; pattes ocre-brun, plus claires par places; partie basale des élytres d'un brun clair légèrement rougeâtre, vers l'extrémité de celle-ci deux ou trois taches claires, cellule basale noire; partie apicale ocre-brun, sur la deuxième branche du médian, deux petites taches noires situées à peu de distance l'une derrière l'autre; ailes ayant la partie basale rouge bordée de brun en arrière et l'apicale (plus de la moitié de la longueur) hyaline à nervures brunes.

Prolongement du front sur le vertex nul, partie supérieure du front seulement légèrement renversée en arrière; rostre dépassant de tout son dernier article les hanches postérieures; trois épines sur les tibias postérieurs.

Longueur du corps 11.5 mm.

Longueur totale 15 mm.

Elytres: longueur 12 mm., largeur $3\frac{1}{2}$ mm.

Hab. N.S. Wales, 1909.

Tribu RHINORTHINI.

(6) *Rhinortha aethiopica*, Schmidt.

Stett. Entom. Zeitung, lxxiv. p. 182 (1913).

Var. nov. *centralis*.

Diffère de la forme type par, 1°, l'absence de la tache allongée située au-devant des yeux (la couleur de la tête est variable, depuis ocre-jaune légèrement teinté de rouge, jusqu'au rouge-brique); 2°, la couleur des pattes, qui sont plus ou moins rouges; 3°, l'absence de taches sur les tibias antérieurs et médians, et, 4°, l'abdomen vert.

Hab. Abyssinie, Maraquo, 20. vi. 1914 (*Kovacs*).

Var. nov. *minuta*.

Diffère par, 1°, la taille plus petite, longueur totale 15 mm., longueur du corps 11 mm., élytres étendus 30 mm.; 2°, l'absence de la tache allongée, située au-devant des yeux; 3°, la couleur de l'abdomen qui est vert au lieu d'être ocre-jaune; 4°, les ailes, toute la partie basale est rouge au lieu d'être jaune, sauf une fine bordure au-devant de la partie apicale brune; 5°, enfin, l'absence de taches sur les tibias antérieurs et médians.

Hab. C. Abyssinie, Lake Horadaka, 1. vi. 1914 (*O. Kovacs*).

Var. nov. *pallida*.

Diffère par, 1°, l'absence de tache allongée au-devant des yeux et de taches sur les tibias; 2°, la coloration blanc-rosé des élytres; 3°, la coloration des ailes dont la partie basale est rose pale et l'apicale brun clair.

Hab. Abyssinie, Lake Zwai, v. 1914 (*O. Kovacs*).

Sous-famille *EURYBRACHINÆ*.Tribu *LOXOCEPHALINI*.(7) *Loxocephala maculata*, sp. n.

Au bord antérieur de la tête une ligne noire allant d'un oeil à l'autre; vertex, pronotum, écusson jaune-brunâtre clair; élytres à la partie basale vert-brun clair, à taches blanc-verdâtre, plus nombreuses vers la partie interne, à la partie postérieure blanc-vert, ayant 2 rangées transversales de taches noires, le nombre de celles-ci varie d'un élytre à l'autre, bord postérieur noir; front jaune, clypeus brun, à base jaune; rostre brun-noir; sont rouge-carmin: le prosternum, les hanches et cuisses antérieures et médianes, la crête longitudinale de la face inférieure des tibias antérieurs, les tibias médians; sont brunâtres: les méso- et métasternum, les hanches et cuisses postérieures, les tibias antérieurs et postérieurs, le bord externe et l'extrémité des tibias médians, les tarses, les organes génitaux, une bande transversale médiane sur le dernier segment abdominal; abdomen jaune.

Yeux présentant une épine à leur partie inférieure; tête un peu moins large que le pronotum; ailes plus larges que les élytres; tibias postérieurs ayant six épines.

Longueur totale 18 mm.

Elytres: longueur 15 mm., largeur 6 mm.

Hab. Tonkin, Chiapa, Juin (*R. V. de Salvaza*).

(8) *Paropioxys infusata*, sp. n.

Front, vertex, pronotum et écusson jaunes; rostre ocre-jaune; sont noirs: le clypeus; sur le front, deux bandes transversales, une au milieu et une au sommet, cette dernière est amincie à la partie médiane; au bord postérieur du vertex, deux taches réunies par une ligne; sur le pronotum quatre taches, dont les médianes sont plus petites; enfin, sur l'écusson, quatre taches à peu près égales, disposées en ligne transversale. Elytres jaune-brunâtre, sur ceux-ci des taches de forme irrégulière, noires vers la base, brunes vers l'extrémité, et dans ces taches foncées des plus petites arrondies, jaunes; près du bord apical, douze à treize taches noires, brillantes. Ailes brun-noir, plus foncées vers l'extrémité. A la face supérieure de l'abdomen les segments sont jaune-brun, bordés de brun en arrière, à la face inférieure, ceux-ci sont jaunes. Organes génitaux brun-noir, brillants. Sternum et pattes ocre-jaune. Sur les cuisses antérieures et les tibias antérieurs et médians, des taches noires. Tarses postérieurs bruns.

Longueur du corps 16 mm.

Elytres: longueur 16 mm., largeur 6 mm., étendus 36 mm.

Hab. Sierra Leone (*Major Smits*).

(9) *Paropioxys versicolor*, sp. n.

Rostre et clypeus rougeâtres; front et vertex bronze clair,

brillants, carène transversale les séparant brun-verdâtre foncé; pronotum jaune-brunâtre; écusson jaune-brunâtre avec une grande tache médiane et deux latérales brunes. Base des élytres d'un blanc légèrement brunâtre, puis une zone olive, s'étendant jusqu'à l'extrémité du tiers basal, cette coloration olive se mue progressivement en brun clair sur le clavus, dans cette zone se trouvent, sur le corium, trois ou quatre taches assez grandes d'un bleu-verdâtre et sur le clavus, une grande tache blanc-brunâtre; ensuite se trouve une large bande blanche teintée légèrement de bleu-verdâtre vers le bord externe; enfin l'extrémité est d'un brun très clair, sur cette dernière partie (à peu près la moitié de la longueur de l'élytre) se trouvent des taches blanches, cireuses. Ailes blanches, à partie apicale brun très clair. Face supérieure de l'abdomen recouverte d'une sécrétion cireuse; face inférieure rouge. Pattes et sternum d'un rouge plus foncé; extrémité des tarses et épines noire.

Longueur du corps 12 mm.

Elytres: longueur 16 mm., largeur 7 mm., étendus 36 mm.

Hab. Northern Nigeria (*A. S. Judd*, 1916).

Tribu PLATYBRACHINI.

(10) *Olonia ornata*, sp. n.

Vertex noir mat, pronotum brun; écusson brun, à partie médiane (comprise entre les carènes en fer-à-cheval) noire. Elytres bruns, à la fin du tiers basal, une bande transversale formée de trois ou quatre taches noires, en avant de celle-ci, sur la partie basale, des taches claires, en arrière de la bande se trouvent de nombreuses taches blanches, dont les plus grandes se voient au bord externe et à la partie apicale; sur la partie postérieure existent également des taches brunes mal limitées, dont la plus grande est oblique partant du bord externe et se dirigeant en dedans et en arrière. Ailes brunes, à extrémité et région anale blanches. Abdomen, brun clair à la face supérieure, ocre-jaune à l'inférieure. Front brun très clair ou jaune-brun; clypeus ocre, à stries latérales rouges; rostre ocre légèrement teinté de rouge. Métasternum ocre-jaune. Cuisses antérieures rougeâtres à la base, brunes ou noires vers l'extrémité, cuisses médianes rougeâtres; tibias antérieurs bruns ou noirs, plus clairs par places; tibias médians ocre-brun, bruns foncé à certains endroits; pattes postérieures ocre-brun, les tibias un peu plus foncés que les cuisses; tarses ocre-brun, à extrémité brun-noir.

Pas d'épine à la partie inférieure des yeux; longueur du pronotum et du vertex réunis moins grande que leur largeur; clavus fermé à son extrémité postérieure, ses deux nervures se réunissant en un tronc commun. Front plan, sans fossettes. Trois épines sur les tibias postérieurs.

Longueur du corps 10 mm.

Elytres: longueur 12 mm., largeur 5 mm., étendus 29 mm.

Hab. Australie, Hermansburg (*H. J. Hillier*).

Tribu DARDINI.

(11) *Metoponitys ornatus*, sp. n.

Front et clypeus bruns, leur suture, une ligne transversale à la partie inférieure du premier, une à la partie supérieure du second, ainsi que la crête de ce dernier ocre-brun; rostre ocre-brun estompé par places de brun; sternum ocre, taché de brun; pattes brun-noir, ocre-brun par places; tibias postérieurs et tarses ocre-brun, l'extrémité de ces derniers est brun-noir; segments abdominaux brun-noir, bordés en arrière d'ocre légèrement brun. Vertex, pronotum ocre-brun, tachés de noir, le second l'est surtout en arrière, à la partie médiane et sur les côtés le long et en dedans des carènes latérales. Écusson brun-noir. Élytres brun très clair, sur ceux-ci des points, des taches et des bandes noires; en avant du milieu de la longueur, une large bande se dirigeant en arrière et en dedans jusqu'à la branche externe du médian, à ce niveau, elle se coude en avant, se rétrécit, est moins marquée jusqu'au clavus et se dirige obliquement, pour arriver près du bord interne à peu près au même niveau qu'au bord externe; l'extrémité est noire, en avant de celle-ci, le bord externe est d'un blanc légèrement teinté de jaune-brunâtre, dans cette bande claire se trouvent des taches noires la séparant en quatre parties; au bord interne, à la partie apicale, se trouvent trois ou quatre petites taches blanchâtres.

Carène médiane du pronotum peu marquée. Ailes plus larges que les élytres, ceux-ci se rétrécissent en arrière, mais ne sont pas effilés en pointe comme dans l'espèce suivante, ils ont leur bord postérieur arrondi et la partie apicale se relève.

Longueur totale 9.5 mm.

Longueur du corps 7 mm.

Elytres: longueur 8 mm., largeur la plus grande 4 mm.

Hab. Gold Coast, Aburi, 1912-13 (*W. H. Patterson*).

(12) *Metoponitys prolongatus*, sp. n.

Front brun clair, traversé en largeur par quatre lignes jaune-brunâtre; sur le clypeus brun, vers la base, une ligne transversale jaune-brunâtre. Vertex, pronotum et écusson ocre-brun, sur le premier une bande le long du bord antérieur, une le long de chaque bord latéral et enfin quatre taches sur le disque, les deux taches médianes sont transversales et très voisines, les deux latérales sont longitudinales; pronotum ayant deux taches brunes médianes, le long des carènes il est taché de brun; sur l'écusson deux grandes taches médianes. Élytres ocre-brun, tachés de brun-noir, cette coloration dessine: 1°, une bande sur les deux tiers antérieurs du clavus (sur sa nervure externe), de là passe sur le corium, plus ou moins bien marquée jusqu'à la branche externe du médian, elle l'est fortement en dehors de celle-ci; 2°, en arrière de cette bande, d'autres transversales et une longitudinale plus ou moins régulières, l'extrémité est également brun-noir, en avant de celle-ci, se trouvent au bord externe cinq taches blanches, quatre grandes et

une petite (la dernière) et au bord externe trois ou quatre petites de même coloration. Ailes brun-noir, ocre-brun vers la base et au bord antérieur; segments abdominaux brun foncé, bordés en arrière d'ocre-brun; sternum et pattes ocre-brun, tachés de brun. Les élytres au niveau de la pointe du clavus, se retrécissent progressivement en une longue pointe. Tibias postérieurs dilatés, aplatis en dehors et en dedans, ayant trois épines. Carène médiane du pronotum très mousse, de celle-ci, au bord antérieur, partent deux carènes latérales, dessinant entre elles un large fer-à-cheval. Ailes plus étroites que les élytres.

Longueur du corps 6 mm.

Longueur totale 10 mm.

Longueur des élytres 9 mm.

Hab. Cameroons, Escalera, 1903-355.

Tribu ANCYRINI.

(13) *Ancyra luangana*.

Tête, pronotum, écusson et sternum ocre-brun; sur le front quatre lignes rugueuses et la carène transversale supérieure, le bord antérieur du vertex et celui du pronotum, sur ce dernier, une bande transversale interrompue au milieu, l'angle postérieur de l'écusson brun-noir. Elytres brun-chocolat à la face supérieure, rouge-pourpre à l'inférieure, leur appendice ocre-brun. Ailes brun-noir, à extrémité brun clair. Yeux gris-brun, épine située à leur partie inférieure brun-noir. Clypeus brun clair tacheté d'ocre-brun. Cuisses brunes et tibias brun-noir, tachetés l'un et l'autre de brun clair. Segments abdominaux ocre-brun clair, le dernier et les organes génitaux sont brun-noir. Toute la surface de l'insecte est assez brillante.

Au bord apical des élytres, à la racine de l'appendice, pas de callosité. Sur le pronotum une saillie transversale.

Longueur totale (sans l'appendice) 14 mm.

Longueur du corps 8.5 mm.

Elytres: longueur (sans l'appendice) 10 mm., largeur 5.5 mm.; longueur de l'appendice 6 mm.

Hab. Luang-Prabang, Ban Samang, 9. xi. 1917 (*R. F. de Salvaza*).

Par l'absence de callosité, cette espèce ainsi que la suivante *A. vicina* se distinguent facilement des autres *Ancyra*.

(14) *Ancyra vicina*, sp. n.

De coloration générale plus foncée que la précédente, les élytres ont une teinte noirâtre vers la base, leur extrémité est brun-clair et leur appendice est noir. Les pattes sont noires, sur les tibias antérieurs, des places sont légèrement plus claires; abdomen brun.

Comme chez *A. luangana* pas de callosité sur les élytres, s'en distingue par l'appendice noir et la taille plus petite.

Longueur totale (sans l'appendice) 11 mm.

Longueur du corps 8.5 mm.

Elytres : longueur (sans l'appendice) 9 mm., largeur 4 mm.;
longueur de l'appendice 5 mm.

Hab. Tonkin, Xieng Khouang, Ban Saï, 8. xii. 1918 (*R. V. de Salvaza*).

(15) *Ancyra xiengana*, sp. n.

Espèce voisine, comme coloration de *luangana*, s'en distingue par la couleur des pattes, qui sont noires, par celle de l'abdomen qui est brun et par la base des élytres plus foncée, l'extrémité de ceux-ci sont comme leur appendice, ocre-brun. Tandis que *A. luangana* et *vicina* n'ont pas de callosité, celle-ci en présente une bien visible, mais beaucoup moins nette et saillante que dans les quatre autres espèces décrites jusqu'à présent et sa coloration est la même que celle de l'extrémité des élytres, ceux-ci, au lieu de se retrécir en arrière, s'élargissent vers leur partie postérieure.

Longueur totale 13.5 mm.

Longueur du corps 10 mm.

Elytres : longueur (sans l'appendice) 12 mm., largeur 6 mm.;
longueur de l'appendice 5 mm.

Hab. Tonkin, Xieng Khouang, Thalan, 20. xi. 1917 (*R. V. de Salvaza*).

Sous-famille CIXIINÆ.

(16) *Anigrus pallidus*, sp. n.

Tête, corps, pattes blanc-ocreaux, abdomen recouvert d'un enduit cireux; écusson gris clair, sur ses côtés trois petites stries transversales brunes. Elytres et ailes d'un blanc-laiteux sale, opaques.

Front creusé en une gouttière longitudinale assez profonde, à bords externes saillants, légèrement plus étroit entre les yeux qu'à son extrémité inférieure, aussi long ou légèrement plus long que deux fois sa largeur. Ecusson sans carène. Radius saillant, granulé jusqu'à sa bifurcation, nervure externe du clavus saillante, granulée, l'interne est simple.

Longueur totale 6 mm.

Elytres : longueur 5 mm., largeur 3 mm.

Hab. Gold Coast, Aburi, 1912-1913 (*W. H. Patterson*).

(17) *Anigrus semihyalinus*, sp. n.

Voisin du précédent, corps d'un blanc-ocreaux; pronotum légèrement brunâtre. Elytres et ailes d'un blanc-laiteux, à moitié transparents.

Sur l'écusson trace de trois carènes longitudinales.

Longueur totale 6.5 à 7 mm.

Elytres : longueur 5.5 à 6 mm., largeur 3 mm.

Hab. Uganda, Kampala, 3. viii. 1921 (*H. Hargreaves*).

Vit sur les caféiers.

XXI.—*Additional Notes on some Branchiosaurs from Odernheim.* By O. M. B. BULMAN, Ph.D., D.I.C., A.R.C.S.

[Plate XII.]

INTRODUCTION.

Odernheim, in the Palatinate of Bavaria, has recently become familiar as a locality for exceptionally well-preserved amphibian remains from the Unterrotliegende. Most conspicuous in this fauna are the small forms belonging to the family Branchiosauridæ, of which three genera, each represented by a single species, have so far been recorded, viz., *Branchiosaurus amblystomus*, Credner, *Pelosaurus laticeps*, Credner, and *Micromelerpeton credneri*, Bulman & Whittard. Descriptions of these species are included in a previous publication by Dr. Whittard and the writer*. Shortly after the completion of that work, however, an opportunity was afforded of visiting the Geologische-Palæontologische Institut of the University of Tübingen, and of examining the Branchiosaur collection there preserved. As a result, further information has been gained on certain points of the structure of *Micromelerpeton credneri*, not clearly shown in the material originally available. Moreover, another specimen from the same locality has lately been acquired by Professor D. M. S. Watson, which constitutes a new species, placed with reserve in the genus *Leptorophus*, Bulman & Whittard (*op. cit. supra*, p. 558).

It is the purpose of the present note, therefore, to give a brief account of the additional features of *Micromelerpeton credneri*, exemplified by the Tübingen material, and to describe the new species in Professor Watson's collection.

My best thanks are due to Professor Baron F. von Huene for his kind assistance at Tübingen and for the generous loan of the specimens concerned; and to Professor D. M. S. Watson, F.R.S., for his ready advice and for laboratory facilities at University College, London. I am indebted also to Mr. J. Thomas for the photographs reproduced here, and for others upon which text-figs. 1-3 have been based.

1. *Micromelerpeton credneri*, Bulman & Whittard.

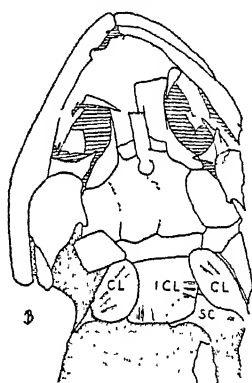
The Pectoral Girdle.—Specimen 81 (Geol. Pal. Inst., Tübingen) is of interest as providing confirmatory evidence for the reconstruction of the pectoral girdle of this species

* Proc. Zool. Soc. pt. ii. 1926, pp. 533-579.

already given (*op. cit.* fig. 12, I. and II.). The elements of the girdle, as shown in the accompanying figure, are here approximately undisturbed, and the paired clavicles partially overlap the large rectangular interclavicle. A portion of one of the scapulæ is seen on the right, the posterior border being fairly sharply defined. The scapulæ were previously unknown in this form, but there are indications of these bones in several of the Tübingen specimens; they are, however, always in a broken condition, and may possibly have been only partially ossified.

The Hind Limb (Pl. XII. fig. 2).—The hind limbs are well-preserved in specimen 6 and rather resemble those of

Text-fig. 1.



Micromelerpeton credneri. Specimen 81, Geol. Pal. Inst.,
Tübingen, $\times 2.75$.

CL, clavicles; ICL, interclavicle; SC, scapula.

Pelosaurus laticeps, in that the tibia is readily distinguishable from the fibula by its greater length and more slender form. There is a large unossified tarsus. The phalangeal formula can now be given as 2, 2, 2+, 3+, 2+, and there can be little doubt that this represents the normal 22343.

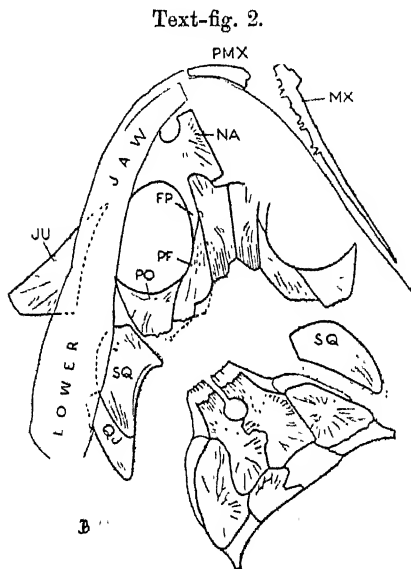
The Body-Impression (Pl. XII. fig. 1).—The narrow elongated body-impression is clearly shown in specimen 5, which is almost entire. The tail is considerably longer than it was represented in the original reconstruction (*op. cit.* fig. 13); measured from the pelvic girdle, the length of the tail is actually as great as that of the presacral vertebral column.

2. *Leptorophus levis* *, sp. n.

Holotype: Nos. 20 and 21 (counterparts) in the collection of Professor D. M. S. Watson, University College, London.

The Cranial Roof.—The bones are very thin, and, although sufficiently well-preserved to show the surface-ornamentation of fine radiating striæ, their outlines are difficult to determine.

The *Tabulars* are broad, but so short as to permit contact between the supratemporals and dermo-supraoccipitals over a considerable distance. The *Parietals* and *Supratemporals*



Leptorophus levis, sp. n. Dorsal aspect of the skull, $\times 2\frac{3}{4}$.
(Specimen 20, Coll. D. M. S. W.)

FP, prefrontal; *JU*, jugal; *MX*, maxilla; *NA*, nasal; *PF*, postfrontal; *PMX*, premaxilla; *PO*, postorbital; *QJ*, quadrato-jugal; *SQ*, squamosal.

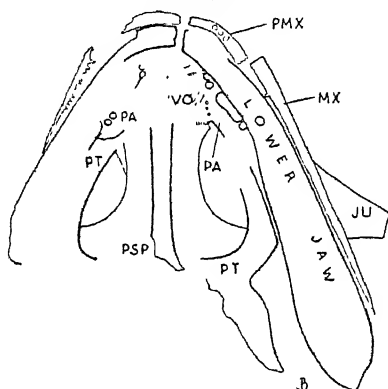
show broad "scarfed" edges anteriorly and laterally for the attachment of the postfrontals, postorbitals, and squamosals. The parietal foramen is anteriorly situated. The *Frontals* and *parietals* are of about equal length and the former are excluded from the orbital margins. The *Lachrymals* and anterior portions of the *Prefrontals* cannot be discerned. The *Postfrontals*, *Postorbitals*, and *Jugals* are large, but an exact

* *Lat., levis, -e*, unsubstantial, light.

outline is known only for the postorbitals; the hinder edge of the postfrontal (text-fig. 2) is apparently broken; the posterior portion of the jugal is well shown, but it is uncertain if this bone extended far enough forwards to meet the lachrymals (as in *Leptorophus tener* (Schönfeld)) or if the maxilla played some part in the determination of the outer margin of the orbit. The *Premaxilla* and *Maxilla* are represented by sections which determine their length and the point to which the hinder end of the maxilla reached back. The *Squamosal* is clearly defined, together with the back of the *Quadrato-jugal*, the anterior end of which is fairly well fixed by the margins of the squamosal and jugal.

The *Palate* is in a less satisfactory condition. Of the

Text-fig. 3.



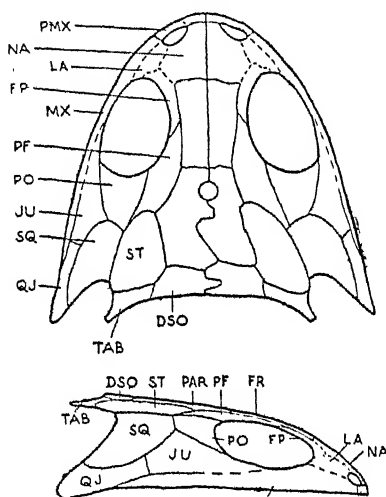
Leptorophus levis, sp. n. Palatal aspect of the skull, $\times 2\frac{1}{2}$.
(Specimen 21, Coll. D. M. S. W.)

PA, palatine; *PSP*, parasphenoid; *PT*, pterygoid; *VO*, vomer;
other lettering as in text-fig. 2.

Parasphenoid, the central portion of the *processus cultriformis* alone remains. The *Pterygoid* possesses a broad gracefully curved quadrate ramus, of which the anterior termination is indefinite. Fragments of the anterior portions of the *Palatines*, with large tusks, are seen on both sides of the skull. The left *Vomer* shows that this bone possessed two large tusks—or, more probably, one tusk and the socket of the replacing tooth—and several smaller teeth. Numerous fine striations, ending abruptly at a transverse line (text-fig. 3), indicate a portion of the hinder margin of this bone, but the outline cannot be determined with certainty. Yet, despite the poor preservation of the vomers and palatines, the impression of the internal naris on the left side is quite distinct.

Affinities.—The thinness of all the bones (including those of the palate), the large quadrato-jugals, the elongated frontals and parietals, and the general shape of the reconstructed skull suggest the reference of this species to the genus *Leptorophus*. There is no evidence whether or not the characteristic Y-shaped palatines of *L. tener* are represented here, nor can it be determined that the circumorbital ring was complete; the latter could only have been broken to admit

Text-fig. 4.



Leptorophus levis, sp. n. Reconstructions of the skull, $\times 2\frac{1}{2}$.

Above, dorsal view; below, lateral view.

DSO, dermo-supraoccipitals; *FR*, frontal; *LA*, lachrymal; *PAR*, parietal; *ST*, supratemporal; *TAB*, tabular; other lettering as in text-fig. 2.

(For the purposes of the reconstruction, since the palatal bones are only imperfectly preserved, the shapes of the roof-bones were cut out in paper and assembled on a plasticine base which had been given the approximate form of known Branchiosaur skulls. The necessary adjustments were then made to allow the bones to fit as accurately as possible, and the above figures have been obtained from camera-lucida drawings of this model.)

the maxilla to the outer orbital margin, as has been tentatively shown in the reconstruction. The pterygoids, retaining as they do the downward flange* on the outer side of the palatal ramus, seem to be of a more primitive type than those of *L. tener*; and the form is less specialised in other features—such as the smaller size of the quadrato-jugal, the more normal

* See Bulman and Whittard, *op. cit. supra*, p. 576.

shape of the squamosal, and the relatively smaller orbits. *Leptorophus levis* may thus occupy an intermediate position between the *Micromelerpeton-Pelosaurus* type and the geologically younger species *L. tener*.

EXPLANATION OF PLATE XII.

Fig. 1. *Micromelerpeton credneri*.^{*} Nearly complete specimen, $\times \frac{5}{6}$, showing body-outline and elongated tail. (No. 5, Geol.-Pal. Inst., Tübingen.)

Fig. 2. *Micromelerpeton credneri*. Pectoral girdle and hind limbs, $\times 1$. (No. 6, Geol.-Pal. Inst., Tübingen.)

XXII.—*On the Structure of the Palate and Mandible of Archegosaurus decheni*, Goldfuss. By W. F. WHITTARD, Ph.D., D.I.C.

[Plate XIII.]

IT is now over eighty years since Goldfuss described the general structure of a new amphibian which he named *Archegosaurus decheni* (1) *; three years later Burmeister (2) gave a description of the cranial roof and a restoration of the palate (2, pl. iv.), but it was not until a decade after the appearance of the original work, when H. von Meyer published his monograph on the osteology of this animal (3), that a really detailed account was available. Several other papers have appeared subsequently (4-15) and the anatomy of *A. decheni* is well-known, excepting that of the palate and the mandible. Within the last few years, Prof. D. M. S. Watson has accumulated a collection of specimens † which sheds much more light on the structure of the palate and lower jaw, and it is the purpose of this paper to describe these parts of the skeleton which hitherto have received but little attention.

TECHNIQUE.

At certain levels, the Lower Permian rocks of Lebach, near Saarbruck (Rhenish-Prussia), contain numerous iron-stone (sideritic) nodules which often enclose portions of the skeleton of *A. decheni*. The preservation of the fossils is

* Numbers within parentheses refer to Bibliography, p. 264.

† The collection is housed in the Zoology Dept., University College, London.

usually good, the original bone being sometimes present in the mineralized state, but more often it has been dissolved, leaving exquisite moulds in the hard ironstone.

If the moulds are not clean they are treated with hydrochloric acid, which removes the bone and has but little effect on the matrix. A thin layer of shellac dissolved in 95 per cent. alcohol is then applied with a camel's hair brush and this, when dry, is covered by a layer of Clove Oil. A heated mixture of gelatine and glycerine, rendered opaque by zinc white* or ground charcoal, is poured upon the specimen or into the cavity of the "hollow" mould; when cool the mixture is elastic and is removed with the fingers, which should be coated with oil. The cast so obtained shows the minutest detail and will keep almost indefinitely. The glycerine-gelatine mixture is invaluable for making casts of "hollow" moulds, because, being elastic, it resumes the shape of the cavity without deformation of outline.

Sub-phylum **AMPHIBIA.**

Order LABYRINTHODONTIA.

Grade RACHITOMI, Cope.

Family Archegosauridæ, Fritsch.

Genus ARCHEGOSAURUS, Goldfuss.

Archegosaurus decheni, Goldfuss, 1847.

Hermann von Meyer made a reconstruction of the cranial roof of *Archegosaurus decheni* in 1857, but judged by the more modern zoological nomenclature, several of the bones were inappropriately named (3, pl. viii. a). Thus the Jochbein (Zygomaticum) is now termed the *jugal*, the Schläfenbein (Temporale) the *supratemporal*, the Zitzenbein (Mastoideum) the *tabular*, the Paukenbein (Tympanicum) the *squamosal*, and the Oberhinterhauptsbein (Occipitale superius) the *dermo-supraoccipital*. There is little to add to the original descriptions of the cranial roof, although attention may be drawn to the relatively small size of the nares, to the posterior process of the tabulars which supported a musculature replacing the post-temporal bone of fishes, and to the deeply excavated otic notches which are of interest because of their relation to the stapes (see p. 259).

* Zinc white was used at the suggestion of Baron F. Nopcsa.

(a) *The Palate.* (Fig. 1.)

The skull is elongated, possessing its greatest breadth at the quadrates; it measures about twice as long as it is broad, being produced anteriorly to form a snout which is bluntly terminated; there is a marked dorso-ventral compression of the skull. In adult individuals the snout is proportionately longer and narrower than in immature forms, and this developmental change is accompanied by a large increase in the size of the premaxillæ. *A. decheni* was an aquatic animal which frequented muddy waters and, as shown by the elongated shape of the skull, it probably preyed on small fishes.

The *Premaxillæ* are paired bones presenting an inner palatal and an outer facial surface; ventrally, at the level of the palate, they are prolonged posteriorly as a thin shelf which effects articulation with the front of the prevomers. Each premaxilla carries a marginal row of six teeth.

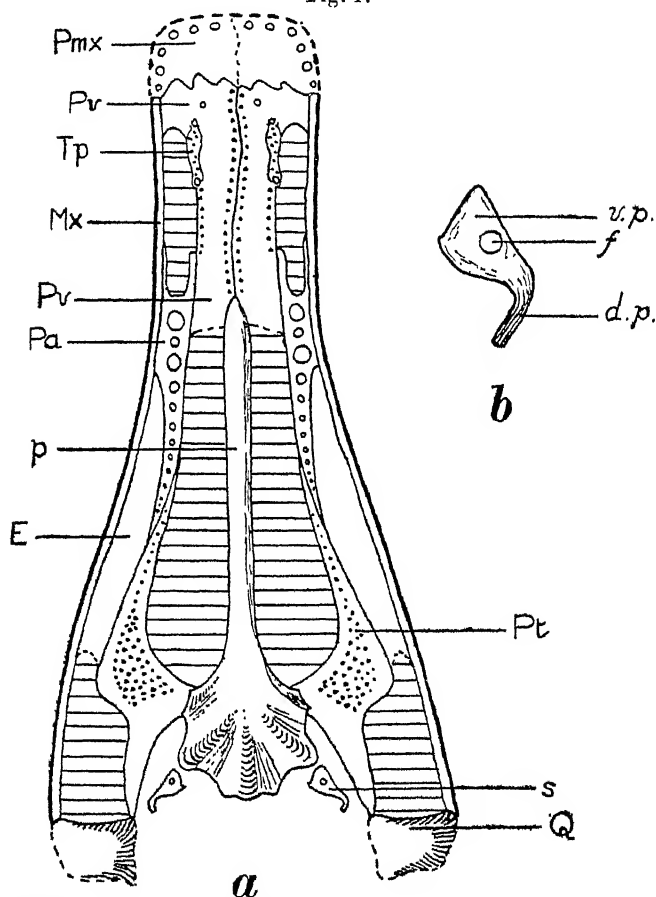
The *Prevomers* are plate-like bones meeting medially and forming a "platform" with the premaxillæ. Laterally, they are pierced by large choanæ, which are bounded posteriorly by the palatines and externally by the maxillæ. The openings of the nares on the palate are much larger than the nostrils, and it seems evident that the former were covered by muscular membranes which carried the nasal orifices. Such membranes would contract while the animal exhaled, and relax when it breathed in air. Each prevomer is provided with a row of small teeth along the common suture and a crescentic row extending from the middle line to the top of a tooth-pit, the latter carrying a large tooth at its anterior extremity and smaller teeth scattered over the depression; another large tooth occurs in front of the pit.

The *Palatines* are elongated bones which, posteriorly, are wedged between the forward-projecting rami of the pterygoids and the transverse bones (ectopterygoids). Anteriorly, each bone divides and is produced as two rami forming the postero-lateral border of the internal naris; the external ramus is applied to the maxilla and the internal ramus makes sutural contact with the prevomer. The palatines are denticerous bones, each having about a dozen teeth which, with the exception of the second tooth, decrease in size posteriorly.

The *Pterygoids* are triradiate bones, of which the anterior (palatine) ramus is the longest. On their ventral surface they possess a large number of minute teeth which are distributed mainly on the anterior rami. Posteriorly, each bone turns through a right angle and ascends as a thin

dorsal flange into the cranium. Internally, the palatine-ramus limits part of the interpterygoidal vacuity, and externally, it is in contact first with the palatine and then with the ectopterygoid. The inner (parasphenoid) ramus appears

Fig. 1.



a. Reconstruction of the palate of a larval form of *Archeogosaurus decheni*, natural size. b. Drawing of the left stapes, $\times 3$. Drawings based on Specs. 1 & 2, Coll. D. M. S. W. and Specs. 40045 & 42754, Coll. B.M. (N.H.).

Mx, maxilla; Pmx, premaxilla; Pv, prevomer; Tp, tooth-pit on prevomer; Pa, palatine; Pt, pterygoid; E, ectopterygoid; p, parasphenoid; Q, quadrate; s, stapes; f, stapedial foramen; d.p., dorsal process of stapes; v.p., ventral plate of stapes.

to repose, at its extremity, upon the dorsal surface of the basiptyergoid process of the parasphenoid, and according to Prof. Watson, "the pterygoid articulates with the basiptyergoid process by a freely movable joint" (13, p. 10). The posterior (quadrate) ramus is inclined vertically, being connected posteriorly with the quadrate. The subtemporal fossæ are comparatively small—a condition which may probably be explained by the elongation of the skull and the presence of long ectopterygoids.

The *Ectopterygoids* are not usually preserved, but from the figure published by von Meyer (3, pl. xiii. fig. 1) they appear to consist of long thin bones attached to the outer margin of the palatines and to the inner side of the maxillæ. They extend backwards some considerable distance, and consequently the subtemporal fossæ are reduced in size.

The *Parasphenoid* is centrally placed, comprising an anterior shaft (*processus cultriformis*) and a posterior lamina. The front of the shaft is wedged between the prevomers, and expands posteriorly to form the basal lamina which is approximately quadrangular in outline. The front of the lamina is limited by the basiptyergoid processes, which stand out as inclined ventral flanges. Dorsally, each process is provided with an articular surface and it is here that the inner ramus of the pterygoid is connected. The basal lamina is ornamented by three ridges and their complementary wide depressions, and it is with the lateral ridges that the ventral parts of the stapes are aligned.

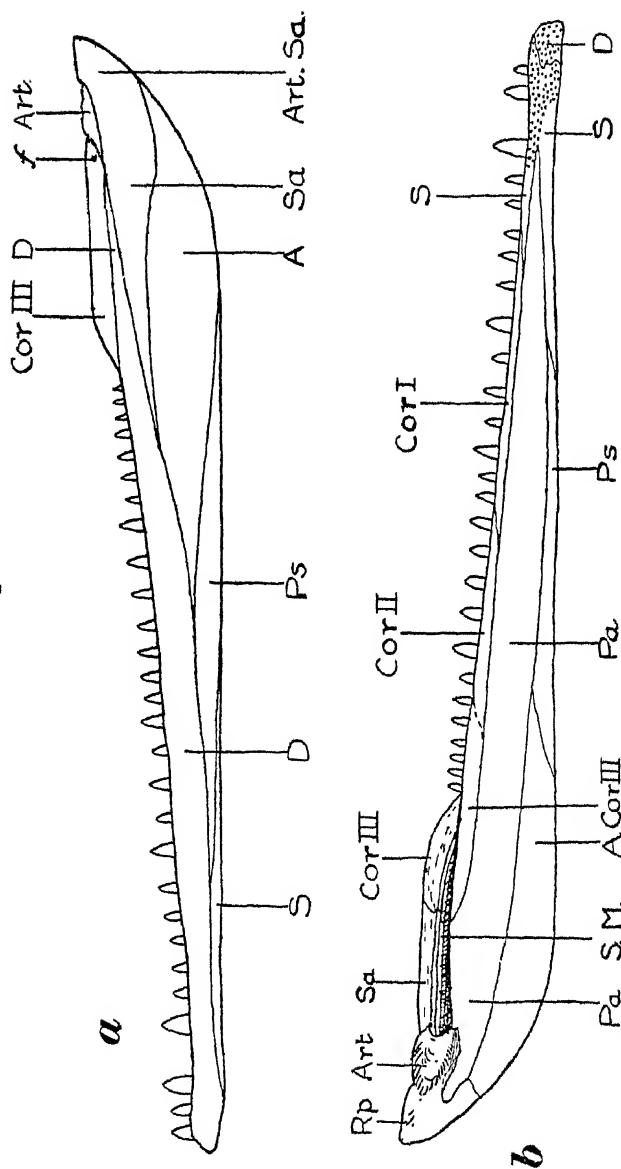
The shape of the *Quadrates* is uncertain, but a knowledge of their general proportions is obtained from the lower jaw where it is articulated to the palate (see p. 262).

The *Stapes* are paired ear-bones, situated postero-laterally on either side of the parasphenoid. The stapes consists of a flattened triangular area, lying in the plane of the palate, which turns through a right angle posteriorly and is produced upwards towards the otic notch as a stout rod. The palatal surface is pierced by a foramen, through which passed the stapedia artery and nerve.

(b) *The Mandible.* (Figs. 2 & 3.)

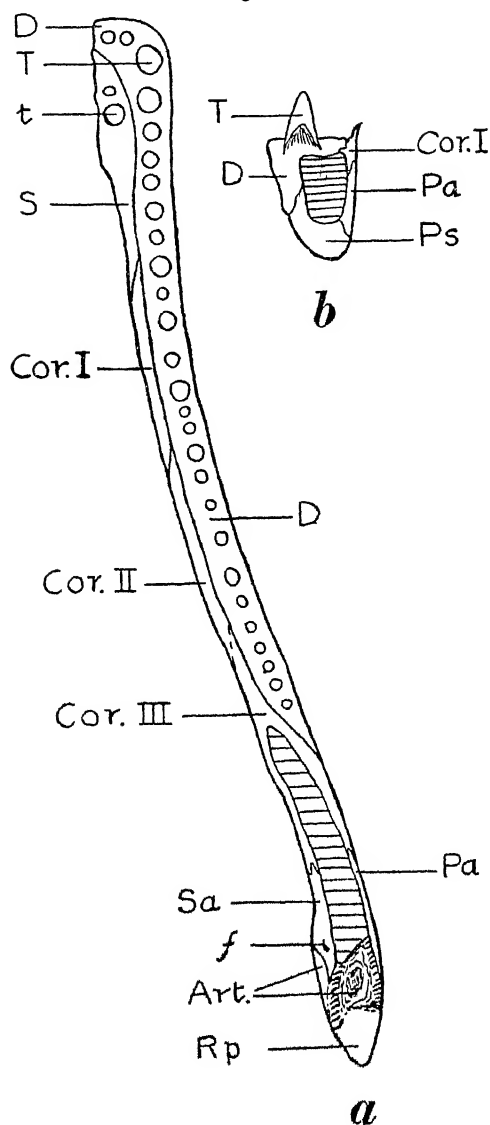
The lower jaw of *A. decheni* comprises ten elements, of which the largest bone is the dentary. The two moieties of the jaw meet anteriorly in a long symphysis formed by the splenial and dentary bones. The very noticeable ornamentation of grooves and ridges is present only on the outside of the mandibular rami (7, p. 507). The *Dentary* is a strongly

Fig. 2.



a. Adult mandibular ramus viewed from outside, half natural size. *b.* Adult mandibular ramus viewed from inside, half natural size. Drawings based on Specs. 3, 4, & 5, Coll. D. M. S. W.
D, dentary; *S*, splenial; *Ps*, postsplenial; *A*, angular; *Sa*, surangular; *f*, foramen in surangular; *Art*, articular; *Art.Sa*, fused articular and surangular; *Rp*, retro-articular process; *Pa*, prearticular; *Cor I, II, III*, coronoids I, II, and III; *S.M.*, supra-Meckelian fossa.

Fig. 3.



a. Adult mandibular ramus, dorsal view, half natural size. *b.* Cross-section of mandible in the region of coronoid I, natural size. Drawings based on Specs. 3, 4, & 5, Coll. D. M. S. W. Lettering as in fig. 2, and in addition *T*, dentary teeth *t*, splenial teeth.

developed bone extending nearly the entire length of the jaw, but it is practically confined to the outer and oral surfaces. It is underlain by the splenial-angular series and sends back a narrow wedge, which lies adpressed to the side of the surangular. The number of teeth in the dentary increases with the development of the animal, and there may be as many as thirty teeth in each ramus. Between two of these teeth, there is occasionally a round depression which indicates the former position of a replaced tooth. In conjunction with its fellow, the dentary constitutes the anterior portion of the *symphysis mandibularis*. Internally, the dentary is united with the splenial and the three coronoids, but since coronoid III divides posteriorly, the dentary does not make part of the margin of the supra-Meckelian fossa.

The *Splenial* is a small bone, forming a digitating suture with the prearticular; it extends upwards to the dorsal surface and its anterior portion is included in the symphysis; it carries two teeth.

The *Postsplenial* and *Angular* elements underlie the dentary and prearticular; they are long splint-like bones, forming with the splenial and dentary the ventral surface of the mandible.

In cross-section the jaw is seen to be narrow and deep posteriorly, but anteriorly it tends to assume a quadrangular shape; fig. 3*b* is a drawing of an intermediate stage in the region of coronoid I. The mandible is thinnest on its inner side, where it is formed of the prearticular, and it is thickest ventrally and externally.

The *Surangular* on its outer side almost entirely overlaps the articular, and it is very probable that these bones are fused; anteriorly, the thin backward-projecting wedge of the dentary overlies a portion of the surangular, which is pierced by a small foramen on its postero-dorsal surface.

The *Articular* is a bifid bone, showing on its dorsal surface an articular area by which the mandibular suspensorium was attached to the cranium, and a posterior retro-articular process (fig. 3*a*). The *musc. depressores mandibularis* descended from the tabular to this process, and the size of the latter is important, because it is an indication of the stage of evolution at which the animal has arrived (see p. 263). Externally, the articular is fused with the surangular, while internally, a posterior prolongation of the prearticular is applied to its surface. From the size of the area of attachment it is possible to determine that the quadrate was trapezoidal in shape.

The *Prearticular* is a long, gradually tapering bone, confined

to the inner side, and bounded dorsally by the coronoids and ventrally by the splenial-articular series. For a short distance it is included in the margin of the supra-Meckelian cavity.

The *Coronoids** consist of three thin bony plates placed on the inner and upper surfaces of the jaw, in juxtaposition, respectively, with the dentary and prearticular; anteriorly, coronoid I abuts against the splenial. They form on their oral surface a narrow ridge separated from the dentary by a groove; coronoid I is supplied with minute teeth. Coronoid III is constructed differently from the other coronoids, because it divides posteriorly and delimits the anterior half of the supra-Meckelian cavity; also, it is the only member of the series to pass on to the outer side of the jaw, where it is in sutural union with the surangular.

AFFINITIES.

Although *Archegosaurus decheni* shows many differences in the construction of the cranial bones from *Trimerorachis* and *Eryops*, yet the similar arrangement of the mandibular elements suggests that these forms are closely related. Also of importance in discussing the affinities of *A. decheni* is the size of the retro-articular process. In Carboniferous Labyrinthodonts, the *musc. depressores mand.* was probably attached to the side of the jaw, since there was no area behind the surface of articulation of the articular bone to carry the muscle. In the latest forms (Triassic), such an area is well-developed, and thus the muscle worked with a greater mechanical advantage, because it had a direct pull on the angle of the jaw. *A. decheni*, which occurs in the Lower Permian rocks, has a small retro-articular process, and hence may be considered to represent an intermediate stage in the evolution of this type of jaw musculature.

I wish to express my gratitude to Prof. D. M. S. Watson for suggesting this research, for his assistance in the interpretation of the skulls, and for laboratory facilities at University College, London. I am indebted to Mr. J. R. Thomas for taking numerous photographs, one of which is reproduced as Plate XIII., and to the Department of Scientific and Industrial Research for permission to pursue this investigation. My best thanks are also due to Prof. Watson and the authorities of the British Museum (Natural History) for the loan of specimens.

* Coronoid I=precoronoid. Coronoid II=intercoronoid. Coronoid III=complementary.

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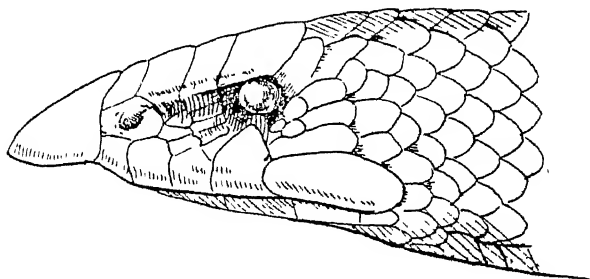
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EXPLANATION OF PLATE XIII.

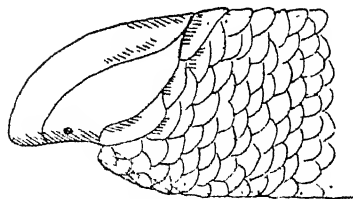
A specimen of an immature *Archegosaurus decheni*, showing the cranial roof viewed from the inside, the stapes (s), part of the basal lamina of the parasphenoid (p), and part of the shoulder-girdle (g). Natural size. Spec. 2, Coll. D. M. S. W.

incorrectly termed "blind slow-worms," being neither blind nor slow, nor worms. *A. gracilicauda* resembles *Typhlops sudanensis* and *Scaphiopus albopunctatus* both in its burrowing habits and its very well-developed rostral. The three examples illustrated in the text-figure are probably the best examples of their respective families.

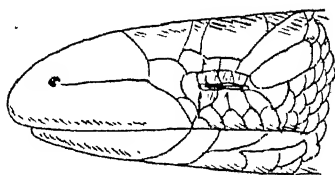
The external similarity is paralleled to a certain degree by the modifications which have taken place in the musculature. In each case there is a great development of the *Cervico-mandibularis* muscle, which is attached to the inner margin of the mandible and is used to produce the downward and sideways motion of the head, with which these burrowing forms progress.



Scaphiopus albopunctatus, Peters.



Typhlops sudanensis, Schmidt.



Acontias gracilicauda, Essex.

This muscle is the one most used in burrowing in a forward direction. To all burrowers, backward locomotion is essential, since it is nearly always impossible for a burrower to turn round in its narrow gallery, and hence it must retrace its steps backward. The mechanism employed in this reversing is a series of slips, from the *Rectus superficialis* muscle, which are attached to the skin. A dissection shows that in each case there is a distinct development of the *Rectus superficialis* slips.

The third muscle used by burrowers is the *Obliquus abdominis externus profundus*, which is attached to the portion of the skull and serves as the complemen-

ervico-mandibularis by bringing the head back to normal after the muscle has moved it downwards and sideways. In this *Obliquus abdominis externus profundus* is well developed in each case.

The fourth muscle, which enables a burrower to "drive" forward and, when on the surface, gives rise to the lateral S-like contortions, is the *Obliquus abdominis externus superficialis*. This muscle in each case is well developed.

Thus we have members of three families whose internal and external modifications, due to similar habits, have progressed along similar lines; but it will be noticed that it is merely a development of an existing system of muscles and shields which has taken place. The lizard *Acontias* has lost its limbs, nearly lost its girdles and the muscles attached thereto; but this also the snakes did before they emerged as snakes in Cretaceous times. It may be that, if these three proceed to specialize along the same lines, they may become so similar as to appear much more nearly related than they really are, and so afford another puzzle for future systematists—*Quod avertat Deus*.

XXV.—*Staphylinid Coleoptera from Rodriguez Island, with the Description of a new Species of Phlæonomus*. By MALCOLM CAMERON, M.B., R.N., F.E.S., and HUGH SCOTT, M.A., Sc.D.

THE purpose of this paper is to place on record six species of STAPHYLINIDÆ included in the collection of insects made in Rodriguez Island by Messrs. H. P. Thomasset and H. J. Snell between August and November, 1918*. These have

* The DIPTERA NEMATOCERA were reviewed by F. W. Edwards, Ann. & Mag. Nat. Hist. (9) xii. pp. 330-337, 1923, and in an INTRODUCTORY NOTE to that paper by Hugh Scott references were given to earlier reports, which embraced the ODONATA, THYSANOPTERA, and certain families of COLEOPTERA. Since that date the following reports have appeared: MICRO-LEPIDOPTERA, by E. Meyrick, Trans. Ent. Soc. London, 1923, pp. 544-557, April 1924; COLEOPTERA, ANTHRUBIDÆ, by K. Jordan, Novitates Zoologicæ, xxxi. pp. 227-230, Oct. 1924; HEMIPTERA-HETEROPTERA and CICADIDÆ, by W. E. China, Ann. & Mag. Nat. Hist. (9) xiv. pp. 427-453, Oct. 1924, with ADDITIONAL NOTES by same writer, *op. cit.* (9) xv. pp. 163-165, Jan. 1925 (followed by an account of yet further species, from a different collection, by the same writer, *op. cit.* (9) xvii. pp. 259-260, Feb. 1926); HEMIPTERA-HOMOPTERA (FULGORIDÆ, sens. lat.), by F. Muir, Trans. Ent. Soc. London, 1925, pp. 463-474, pls. 46, 47, Feb. 1925; DIPTERA, other than Nematocera, by M. Bezzi and O. G. Lamb, Trans. Ent. Soc. London, 1925,

all been determined by the first-named writer of the paper and the description of the new species is due to him alone so that it should be cited as "*Phlaenomus inconspicuus*, M. Cameron"; to him also must be described the remarks on the synonymy of *Gyrophæna waterhousei*. The second-named writer is responsible for the general compilation of the paper.

Three species of STAPHYLINIDÆ were collected in Rodriguez by the 'Transit of Venus' Expedition, and were described as new by C. O. Waterhouse, Ann. & Mag. Nat. Hist. (4) xviii. pp. 107-109, 1876, the descriptions appearing again in nearly the same form in Phil. Trans. R. Soc. clxviii. extra vol., pp. 513-515, 1879; only a single specimen of each species was found. One of these species, *Aleochara parvula*, which proves to be a *Gyrophæna*, does not appear to have been found in any other part of the world, and it was not rediscovered in Rodriguez by Thomasset and Snell. The second, *Homalota destituta*, is a synonym of the very widespread *Atheta dilutipennis*, Motsch., and it was collected in Rodriguez again by those investigators. The third, *Lithocharis occulta*, is synonymous with the widely-distributed *Medon debilicornis*, Woll.; it was not rediscovered in Rodriguez by Thomasset and Snell.

The known STAPHYLINIDÆ of Rodriguez would therefore appear to number eight, six of which are widely distributed, while two (*Gyrophæna waterhousei*, M. Cam. (*Aleochara parvula*, Waterh.) and *Phlaenomus inconspicuus*, M. Cam.) are recorded only from that island. From the Seychelles, which lie nearly 1200 miles from Rodriguez, a little West of North, eighty-one species have been enumerated (Bernhauer, Trans. Linn. Soc. London, ser. 2 (Zool.), xviii. pp. 165-186; 1922; and Scott, t. c. pp. 187-193); but only three species are known to be common to the Seychelles and Rodriguez—namely, *Oxytelus ferrugineus*, Kraatz, *Medon debilicornis*, Woll., and *Atheta dilutipennis*, Motsch.

The eight species from Rodriguez are therefore as follows—
The summaries given of their general distribution correspond with those in Bernhauer's Catalogue of Staphylinidæ

pp. 537-573, Feb. 1926; and NEUROPTERA, CHRYSOPIDÆ, a single species, incorporated in a report on those of the Seychelles by P. Esben-Petersen, Ann. & Mag. Nat. Hist. (9) xix. pp. 445-455, pls. ix.-xi., April 1927. The working-out of the whole collection is therefore well advanced, the parts remaining to be done comprising a very few examples of THYSANURA and PSOCOPTERA (COBROGNATHA), a rather large material of HYMENOPTERA, certain families of COLEOPTERA and of HEMIPTERA-HOMOPTERA, and the MACRO-LEPIDOPTERA.

Coleopt. Cat., Junk und Schenkling, parts 19, 29, 40, 57, 77, 82, 1910-1926), except in the case of *Oxytelus ferrugineus*, where several localities are added by the first-named writer of this paper:—

1. *Phlaeonomus inconspicuus*, M. Cam.; sp. n., described below.

Known only from Rodriguez (*Thomasset and Snell*).

2. *Oxytelus ferrugineus*, Kraatz, 1859.

Rodriguez (*Thomasset and Snell*).

Widely spread; India, Ceylon and Indo-Malay islands, Japan, Formosa, Hawaiian Is., Seychelles, Madagascar, Comoros, Zanzibar, Aden, Natal, Cape Verde Is., and parts of Central America and the Antilles.

3. *Astenus leptocerus*, Epp., 1895.

Besides Rodriguez (*Thomasset and Snell*), known only from India and Ceylon.

4. *Medon debilicornis*, Woll., 1857 (*Lithocharis occulta* Waterh., 1876).

Rodriguez ('*Transit of Venus*' Expedition).

Almost world-wide; Europe, Mediterranean, Africa, Madeira, Persia, India, Japan, Seychelles, parts of North, Central, and South America, Australia, and the Hawaiian Is.

5. *Philonthus flavocinctus*, Motsch., 1858.

Rodriguez (*Thomasset and Snell*).

Also India, Ceylon, Mauritius, and Réunion.

6. *Philonthus nigrutilus*, Grav., 1802.

Rodriguez (*Thomasset and Snell*).

Europe, Siberia, Mediterranean, North America, Chile, Australia.

7. *Atheta dilutipennis*, Motsch., 1858 (*Homalota destituta*, Waterh., 1876).

Rodriguez ('*Transit of Venus*' Expedition and *Thomasset and Snell*).

India, Ceylon and Indo-Malay islands, Canaries, Cape Verde Is., and parts of Tropical Africa.

Staphylinid Coleoptera from Rodriguez Island.

8. *Gyrophæna waterhousei*, nom. nov. (M. Cam.).

Aleochara parvula, Waterhouse, Ann. & Mag. Nat. Hist. (4) xv. p. 107, August 1876.

Nec *Gyrophæna parvula*, Sharp, Trans. Ent. Soc. London, 1876, part i, p. 73, May 1876.

Aleochara parvula was described by Waterhouse from a single ♀ example. It proves to belong to the genus *Gyrophæna*, but is probably not referable to any of the known Oriental species of that genus, though its being of the ♀ sex renders precise determination difficult. The species may, therefore, still be regarded as only recorded from Rodriguez, but it cannot retain the specific name *parvula*, that name being preoccupied in *Gyrophæna* by *G. parvula*, Sharp, from the Amazons, which was described only a few months earlier than *Aleochara parvula*. It is therefore proposed that the species should be known as *Gyrophæna waterhousei*, M. Cameron.

Rodriguez ('*Transit of Venus*' Expedition).

DESCRIPTION OF A NEW SPECIES OF *PHLÆONOMUS*
FROM RODRIGUEZ ISLAND.

By MALCOLM CAMERON.

Phlænomus (s. str.) *inconspicuus*, sp. n.

Black, the apex of the abdomen pitchy, moderately shining; thorax with four impressions. Antennæ with the first four joints pitchy, the rest black. Legs pitchy testaceous.

Length 1.5 mm.

A small parallel depressed species. Head with a small longitudinal impression before each ocellus, on either side in front within the antennal tubercles lightly impressed, finely and very sparingly punctured, distinctly coriaceous. Antennæ rather short, the third joint shorter than the second, fourth moniliform, fifth and sixth small, transverse, seventh to tenth much more transverse and increasing in width, the penultimate joints fully twice as broad as long. Thorax transverse, broader than the head, with four slight impressions, the median extending from the base to beyond the middle, the lateral narrower, shorter and a little deeper, in the middle line with a fine sulcus at the base. Sculpture as on the head. Elytra parallel, twice as long as the thorax, less finely and much more closely punctured, coriaceous. Abdomen coriaceous, with a few extremely fine punctures.

Rodriguez Island, viii.-xi. 1918 (*Thomasset and Snell*).

XVI.—*New Helicoid Snails from the Mohave Desert.*—II.*

By S. STILLMAN BERRY, Redlands, California.

IN the former paper cited (see footnote) two species of land-snail found in the southern portion of the Mohave Desert were described as new, and, on the basis of their shell-characters only, were tentatively referred to the more characteristically Upper Sonoran group *Helminthoglypta* rather than to the peculiarly Lower Sonoran and xerobic *Eremarionta*, to which it might have been easily anticipated they would prove to belong. A specimen of one of the species (*graniticola*) was sent in the living state to Dr. Henry A. Pilsbry, who found opportunity for the investigation of the anatomy before the writer, and who accordingly has lately written that he finds anatomy and shell in full accord, the species in question being a true *Helminthoglypta* allied to *cuyamacensis*, but differing characteristically in the proportions of several organs. It is therefore with stimulated interest that I am able to report the discovery of three additional species from other localities in the same Desert, all apparently closely allied with the foregoing, and without question referable to the same genus. One of these (*jaegeri*) pushes the distribution of this group well to the north and into territory which until recently we would have anticipated to lie well within the domain of *Eremarionta*.

Helminthoglypta jaegeri, sp. n. (Figs. 1-4.)

Description.—Shell of moderate size and thickness, depressed-conic in outline, often nearly discoid; whorls convex with well-grooved sutures; last whorl well produced parietally and slightly descending in front. Aperture ovate, strongly oblique. Peristome distinctly thickened, but only slightly reflected, even where it becomes produced as it joins the umbilicus. Umbilicus wide, permeable to the apex, and in diameter usually about one-sixth or one-seventh the diameter of the shell.

Spiral sculpture wanting, but almost the entire surface of shell very minutely, weakly, and often quite obsoletely papillose, the papillation especially evident on the lower surface just back of the aperture, but elsewhere usually greatly obscured by the closely crowded and microscopically quite strong incremental striae.

* No. I. of these studies appeared in this Journal, ser. 9, xviii. pp. 490-493, under the title "Two new Helicoid Snails from the Mohave

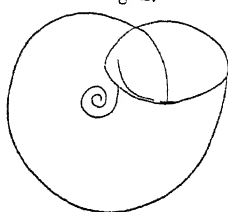
Helicoid Snails from the Mohave Desert.

Periostracum thin, in colour a light Buffy Brown on the spire of a nearly fresh shell, with the base a tone paler and with a very narrow and rather dim peripheral band Saccardo's Umber. A somewhat wider area adjacent to the band above and below it seems to be paler in tone like the base.

Fig. 1.



Fig. 2.

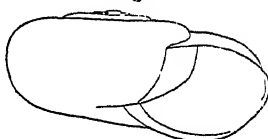


Helminthoglypta jaegeri, type-specimen.

Fig. 3.



Fig. 4.



Helminthoglypta jaegeri, paratypes.

Measurements. — Caliper-measurements of ten mature specimens are as follows:—

	Maximum diameter.	Minimum diameter.	Altitude.	Diameter of umbilicus.	Number of whorls.
	mm.	mm.	mm.	mm.	
Paratype..	19.4	16.2	8.5	3.1	5
Paratype..	18.7	15.6	9.4	3.2	5½
Paratype..	18.2	15.0	9.5	3.0	5½
Paratype..	18.2	15.3	8.5	2.8	5
Paratype..	18.0	15.0	9.7	2.8	5½
Paratype..	17.3	14.4	8.5	2.7	5
Paratype..	17.3	14.3	9.1	2.4	5
Paratype..	17.1	14.3	8.4	2.5	5
Type	17.1	13.8	8.0	3.0	5
Paratype..	15.3	12.5	7.2	2.1	4½

Type.—Cat. No. 6300 of the author's collection. Paratypes No. 6301 of the same collection; others to be deposited in the collections of Mr. Allyn G. Smith and the Academy of Natural Sciences of Philadelphia.

Bernardino County, California; 26 mature and 19 immature shells, dead and mostly bleached; E. C. Jaeger coll.; April 18, 1927.

Remarks.—Although no living specimens are at hand to make possible a study of the animal, this characteristic snail of the southern Mohave is very evidently of the same group as the recently-described *graniticola* and *mohaveana*, together with the older *cuyamacensis*, Pilsbry *. Of the three it seems nearest allied to *graniticola*, but differs conspicuously in the larger size, thicker shell, flatter spire, and wider umbilicus. The number of whorls is likewise rather less in average specimens despite the larger shell.

It is named for Professor Edmund C. Jaeger, of Riverside Junior College, who not only collected the specimens, but whose love for and indefatigable investigation of the far recesses of our Californian deserts renders this but a small honour to bestow.

Helminthoglypta crotalina, sp. n. (Figs. 5 & 6.)

Description.—Shell of moderate size and thickness, depressed conic in outline; whorls convex, sometimes with a slight indication of shouldering, the sutures well grooved

Fig. 5.

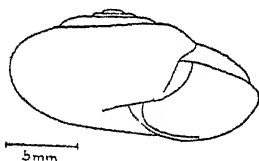
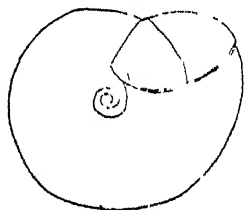


Fig. 6.



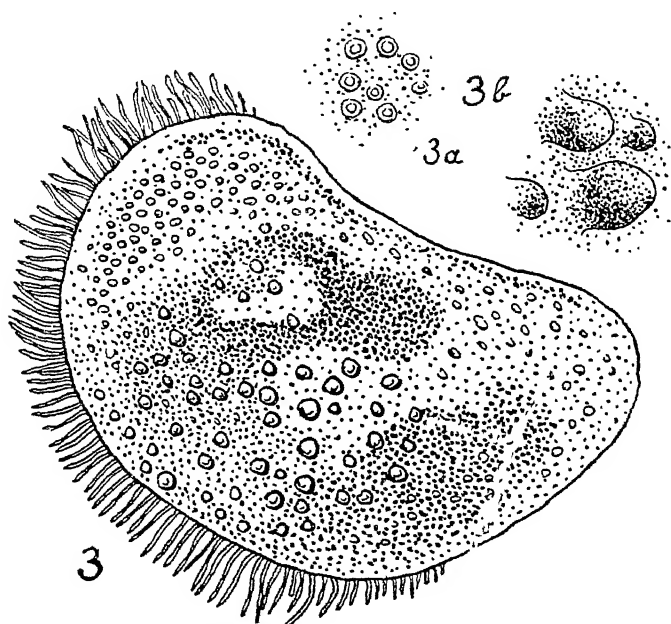
Helminthoglypta crotalina, type.

out; last whorl produced parietally and descending in front. Aperture rounded ovate, oblique. Peristome only slightly thickened and reflected, even at the umbilicus. Umbilicus permeable to the apex, but of only moderate width, usually contained in the major diameter about seven or eight times.

Spiral sculpture wanting, but almost the entire surface

* This was ostensibly described by Bartsch in 1916 as a new species, using a MS. name originally applied by Hemphill, but, as the anatomy was described and figured under the same name by Pilsbry in 1895, Art. 27 of the International Code necessitates taxonomic acknowledgment

length. The dorsal cirri are long, reaching to beyond the ends of the bristles, and the ventral are short and enlarged at the base.



Parahalosydna chinensis, sp. n.

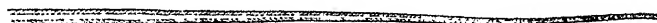
Fig. 3.—Anterior elytron. $\times 30$.

Fig. 3 a.—Small tubercles. $\times 80$.

Fig. 3 b.—Large tubercles. $\times 80$.

There are fifteen pairs of elytra, reaching to the end of the body and meeting in the median line (fig. 3). They are mottled with brown, heavily fringed on their external margin, and covered with minute tubercles (fig. 3 a). The

Fig. 4.



Parahalosydna chinensis, sp. n. Dorsal chæta. $\times 100$.

first three pairs have also a number of large tubercles and a granular surface (fig. 3 b).

With regard to the feet, the notopodium is much

but not so much as is usual in *Halosydna*. There is a small bundle of exceedingly fine, hair-like, delicately-barbed chaetae (fig. 4). The neuropodium has a fan of stout bristles, with strongly curved tips and a short pectinated area. There is a pair of long pygidial styles.

Remarks. Horst (1917, p. 83) established the genus *Parahalosydna* to include species with a lepidonotid type of prostomium, fifteen pairs of elytra, and a reduced notopodium. As he has pointed out, *Malmgrenia* is really a harmothoid genus.

This new species is easily distinguishable by its nuchal peaks, the distribution of the large elytral tubercles, and the dorsal chaetae. Horst's *Parahalosydna sibogae* is the only other member of the genus.

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XXXVIII.—*A special Proodont Race of Water-vole, occurring in Northumbria.* By OLDFIELD THOMAS.

true water-voles—genus *Arvicola*, as now restricted—has been written on the extent to which the incisors are modified by being more or less projected forward, more or less in correlation with this, on the extent to

which the occipital plane is slanted forwards in the more proodont types. No doubt, there is a correlation between the two characters, conspicuous in such extreme types as *Spelæx* and similar animals, and therefore the proodonty of such voles as the Swiss *Arvicola scherman exitus*, accompanying as it does a considerable degree of occipital slanting, has been taken as being in almost necessary correlation with the latter, due presumably to more burrowing habits of life. In Hinton's recent work on voles much of interest on this subject occurs, and he gives a description of a Pleistocene vole, *Arvicola abbotti**, in which the proodonty is considerable, as is also the correlated occipital slanting.

Now, however, it is of much interest to find that there is a local race of the British water-vole in which also the proodonty is considerable, while at the same time the usual correlation is absent, for there is no special occipital slanting whatever.

To illustrate the degree of proodonty we have, fortunately, available the method worked out by me in 1916-1919, by which a fairly accurate measurement can be taken of the angle at which the incisors issue from the jaw. This method is illustrated in the 'Annals' for 1919 with a figure †.

Now of British *Arvicolæ*—all referable to *A. amphibius*—the following is a series of incisive index-numbers, arranged geographically, which will bring out the feature I wish to emphasize:—

Scotland (representing *A. a. reta*) : 88, 92, 94, 88, 97, 91.
Average 92.

Northumberland : 96.

Hull : 96, 97, 101.

Huddersfield, Yorks : 97, 98, 97, 99, 102. } Average 97.

Average 99.

Hereford, Wilts, Herts, Somerset, Dorset (7 specimens) :
90-92. Average 91.

Surrey (13 specimens) : 87-92. Average 90.

It will thus be seen that while in Scotland and the major part of England the incisors are very orthodont—much the same, in fact, as those of the large voles of Scandinavia.

* Monogr. Voles, pp. 397-414 (1926).

† Ann. & Mag. Nat. Hist. (9) iv. p. 289 (1919). The way of this angle, always a little difficult, is increased in voles by the lip, molar grinding-surface not being a straight line, but a curve. However, done my best to take the chord of the curve by eye. Latitude must, however, be allowed in any individual case.

France, and Spain, representing *A. terrestris*, *sapidus*, and *tenebricus*,—those from the Northumbrian area are decidedly proodont, equalling or falling little short of the Swiss *A. scheraman exitus* (103° – 104°), while the remarkable *A. abbotti* only slightly exceeds them (105°). Both the latter have slanting occipitals in correlation with their more burrowing habits.

To emphasize this difference in the set of the incisors, it would seem advisable to give the Northumbrian animal a special subspecific name, which might be

*Arvicola amphibius brigantium**, subsp. n.

General characters as in true *A. amphibius*† of southern England, but the incisors more proodont, the incisive angle upwards of 97° , as compared with 90 – 91° in *amphibius*. Occipital plane as upright as in *amphibius*.

Dimensions of the type :—

Head and body 186 mm. ; tail 95 ; hind foot 24.

Skull: greatest length 41 ; condylo-incisive length 41.5 ; zygomatic breadth 24 ; nasals 11×4.3 ; mastoid breadth 18.5 ; palatilar length 22 ; incisive index 102° ; upper molar series 10.

Range. Northumberland to Yorkshire—locality of typical series Huddersfield ; alt. 760'.

Type. Adult female. B.M. no. 27.10.6.7. Original number 7. Collected 15th October, 1927, by Kenneth D. Parker. Presented by Oldfield Thomas. Nine specimens examined.

Mr. Hinton has had for many years an inkling of the occurrence of this proodont water-vole in Northumbria, but, on the accidental falling into my hands of the Huddersfield material, he has, with characteristic liberality, insisted on my describing it, giving me at the same time much helpful advice on the subject.

XXXIX.—*The Transvaal Race of the Common S.-African Wild Cat.* By OLDFIELD THOMAS.

As indicated by the results of Capt. Shortridge's explorations S.W. Africa, the common wild cat, *Felis ocreata*, is a somewhat plastic animal, with a tendency to form local races in different areas. I have now compared the

gigantes, "a tribe occupying the district between the Tyne and the" (Encycl. Brit.).

published his books in London, and died in Essex, so southern would naturally be the type-region of the name *amphibius*, through Linnæus, depends ultimately on him.

Transvaal specimens of this group obtained by Major Claude Grant during the Rudd exploration with examples representing the true *F. ocreata cafra* of the Cape, of which an excellent skin from Cape Agulhas, presented by Capt. Selous, may be taken as typical.

The Transvaal form may be described as follows:—

Felis ocreata rusticana, subsp. n.

General colour more buffy-tawny than in *cafra*, not so grey. Blackish of the markings on the body tending to be replaced by ochraceous; this is especially the case with the spots on the belly, which are black in *cafra*, ochraceous, as in *namaquana* and others, in the Transvaal form. Limbs with much less black on them, the black of the hands restricted to the palms and one ring near the elbow, while in typical *cafra* the whole underside of the forearm from elbow to palm is deep black. Soles similarly less black, the black not extending back to the heels. Tail not so heavily blackened as in *cafra*, nor are its light rings so clear or grey.

Dimensions of the type:—

Head and body 526 mm.; tail 326; hind foot 136; ear 65.

Skull: greatest length 98; condylo-basal length 88; zygomatic breadth 71.

Hab. Transvaal. Type from Zuurbron, Wakkerstroom District. Alt. 1600 m. Another specimen from Turfloop, E. of Pietersburg.

Type. Adult female. B.M. no. 6.9.1.27. Original number 776. Collected 18th May, 1904, by C. H. B. Grant, and presented by Mr. C. D. Rudd. Three specimens.

Distinguishable by the greater buffiness of the general colour, the ochraceous spots on the belly, and the reduction of the black on the limbs.

Of four wild cats from Deelfontein—a place which always tends to have intermediate or connecting forms—two are quite like true *cafra*, while two are intermediates between that and the Transvaal animal.

XL.—*A new Fossil Form of Phasmatodea from Galkino (Turkestan), and on Mesozoic Phasmids in general.*

A. B. MARTYNOV (Zoolog. Mus. Acad. Sci., Leningrad)

IN 1926 a series of Fossil Insects had been collected at Galkino, Turkestan, by Dr. B. Prynada, of the Geological Committee, Leningrad, and kindly placed by him at my disposal for examination. A wing in good condition, resembling in many characters of venation the costo-

portion of the posterior wings in the recent Phasmatodea specially attracted my attention. Further examination showed that the neuration of this anterior wing partly agrees with that of the anterior wings in the genus *Necrophasma*, Mart.*; from the Upper Liassic beds of Galkino, partly, and even still more closely, with that of the wings in *Aeroplana mirabilis*, Till., the peculiar form from the Upper Trias of Australia, described by Tillyard in 1918†. I was inclined to consider the genus *Necrophasma* as falling into the order Phasmatodea, but, owing to the striking difference existing between this genus and the recent Phasmatodea, I separated it into a distinct family and even into a new sub-order Necrophasmatodea (1925). The wing under description (*Aerophasma*, gen. nov.), bearing resemblance both to *Necrophasma* and recent Phasmatodea, undoubtedly belongs to the same order. Its affinity to the genus *Aeroplana*, Till., permits me to determine also the systematic position of this Australian genus, previously considered by Tillyard as belonging to the order Protodonata, then placed into a separate order Aeroplanoptera‡, in some characters resembling Protorthoptera, but originating according to Tillyard from the Palæodictyoptera. The genus *Aeroplana*, Till., also belongs to Phasmatodea, being more closely related to the new genus *Aerophasma*.

Family Aerophasmidæ, nov.

Anterior wings long, narrow; longitudinal veins well developed and mostly parallel; costal region rather broad in the basal part of the wing, narrowing to the end; *SC* ending on *C* long before the end of the wing; *R* strong; *RS* branching off from it by one root in the basal part of the wing and forming several (few) branches in the apical portion of the latter; *M* divides near its base into two main branches, each soon dividing anew and forming two long branches; *Cu* simple and long; first to third analia parallel; *A*₁ and *A*₂ joined together near the middle of the wing; cross-veins rather numerous and regular; the net wanting.

Genus AEROPHASMA, gen. nov.

Costal region of anterior wings gradually narrowing to the *SC*; *SC* running closely to *R* and ending on *C* near

* Il. Acad. Sci. Russie, 1925, p. 584, fig. 8.

† Proc. Linn. Soc. New South Wales, 1918, vol. xliii. pt. 3, p. 425, figs. 14-16.

‡ Ibid. 1923, vol. xlviii. pt. 4, p. 481.

the end of the second third of the wing; *R* thick, strongly developed; *RS* parallel to it, branching off from *R* by one root and forming apparently three branches in its end portion; posterior main branch of *M* (*MP*) divides nearer to the base than the anterior one; *Cu* simple; analia straight, parallel; A_2 united with A_1 near the middle of the wing, as is A_3 with A_2 , but somewhat more to the base; behind the anal nervures there is a narrow strip of membrane bearing several feeble and partly indistinct veins.

Genotype. *Aerophasma prynadai*, Mart. Galkino (Upper Lias), Turkestan.

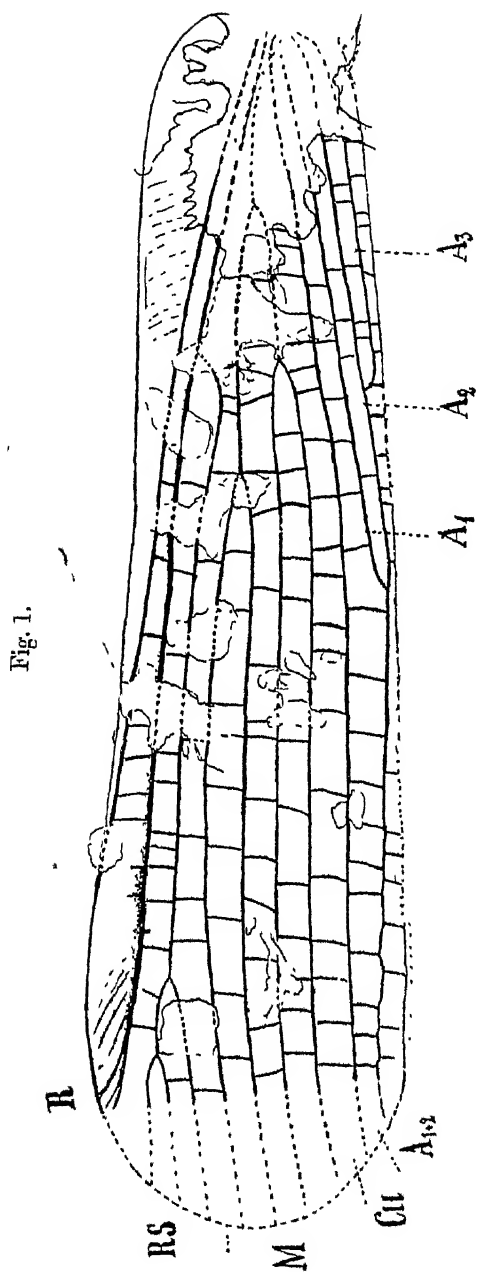
Aerophasma prynadai, sp. n.

One specimen, Galkino, Karatau, Turkestan (*B. Prynada*, 1926).

The specimen represents an anterior wing in good condition.

Nervures dark brown. Neuration lacking, except in the basal portion of the wing and in small spots along *R*, *M*, and *Cu*; moreover, a small apical portion is broken off—the neuration restored is shown in fig. 1 by dotted lines. Length of the fossil as preserved from the base to the end of *R* 24 mm.; breadth 5 mm., reaching almost 6 mm. at the level of the branching of *RS*. Total length of the wing must have been about 26 mm. *SC* running closely to *R*, connected with it by a few cross-veins and ending on *C* at the end of the second third of the wing; costal region with indistinct transverse slender stripes; *R* strong, in its end portion somewhat deviating from the costal margin, thus forming an elongated and not limited pterostigma dark brown in colour. *RS* with three branches; posterior main branch of *M* (*MP*) divides into two secondary branches at the origin of *RS*, anterior one (*MA*) divides somewhat farther. *Cu* simple, parallel to the hind branch of *M*; analia parallel, running rather close one to another; A_2 united with A_1 near the middle of the wing and then prolonged by a simple longitudinal vein; A_3 united with A_2 somewhat more to the base. Cross-veins rather numerous, but situated at various distances.

I consider this specimen as representing the anterior wing owing to the fact that just behind A_3 there is a membrane-stripe provided with several cross-veins. If this wing is the posterior one, the long and strong branches of A_3 originate immediately from A_3 , as in recent Phasmids.



Aerophasna pryadai, gen. et sp. n. Anterior wing.

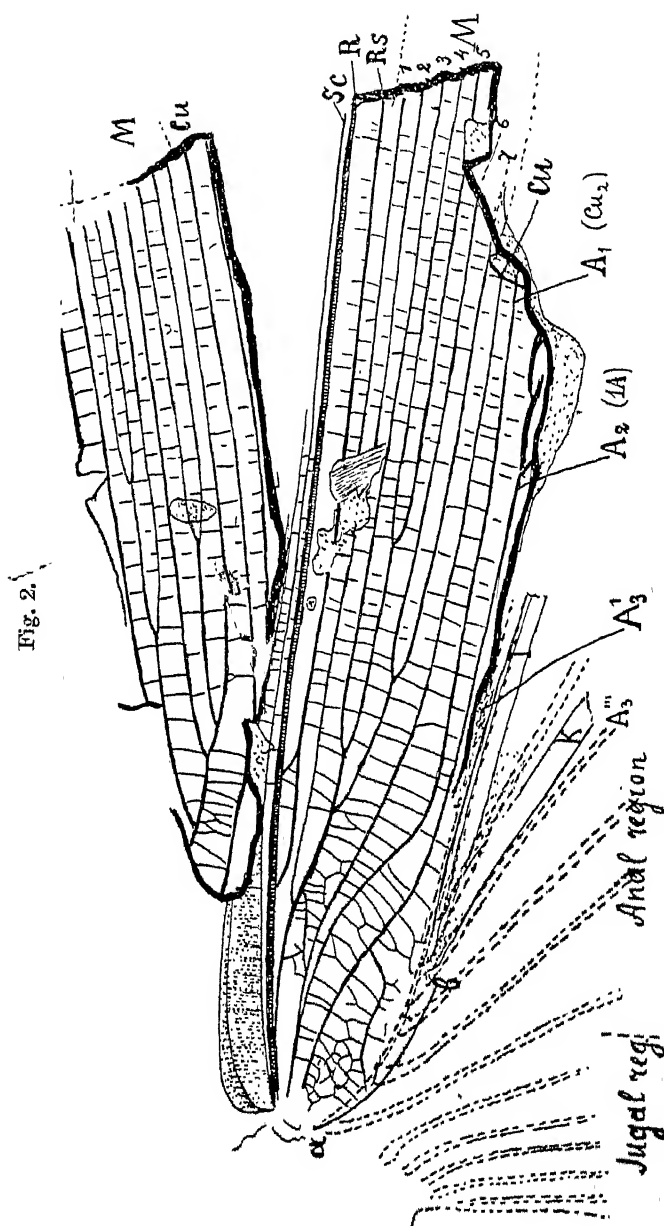
DISCUSSION ON THE AFFINITIES OF THE GENUS *AEROPHASMA*.

A comparison of the wing just described with the wings of the genus *Aeroplana*, Till., clearly shows that the genus *Aerophasma* is more allied to this than to any other genus. Thus the family Aeroplanidæ, Till., falls also into the order Phasmatodea. In its general structure, in the shape of the costal region, and in the character of the whole neurulation the wing of *Aerophasma* bears, indeed, a great resemblance with the anterior and with the costo-cubital portion of the posterior wing of *Aeroplana*, and one can doubt, perhaps, the correctness of the separation of the genus *Aerophasma* into a distinct new family. However, I should think that such features as the branching of *RS*, the rather simplified structure of *M*, and the somewhat different position of the analia is sufficient for ranking the genus *Aerophasma* into a separate family, though allied to Aeroplanidæ.

In certain characters (*RS* branched, character of analia) *Aerophasma* appears as being more primitive, in others (*M* more simplified, *Cu* simple) exhibiting some features of specialisation, and somewhat resembling both the recent Phasmids and the fossil genus *Necrophasma*. The family Necrophasmidæ differs more distinctly from both Aeroplanidæ and Aerophasmidæ. In this family, *M* is much more simplified, being only two-branched; contrary to this, *Cu* and analia have preserved a more archaic condition. It differs also by the more narrow costal region, sparse cross-veins, and by *RS* originating somewhat more to the end.

Returning to *Aerophasma*, we may note that the branching of *RS* is a most interesting feature. In the recent Phasmidæ, as well as in *Necrophasma* and *Aeroplana*, *RS* is simple; however, should we agree that the order Phasmatodea is allied to Orthoptera Saltatoria, and had originated from some common group of more primitive Protorthoptera, it would be necessary to admit that in this order as well *RS* formerly had several, though not numerous, branches. This presumption is confirmed by the condition observed in *Aerophasma*. As shown by the genera *Aerophasma* and *Aeroplana*, *M* might have previously been more composite than it is in recent Phasmids.

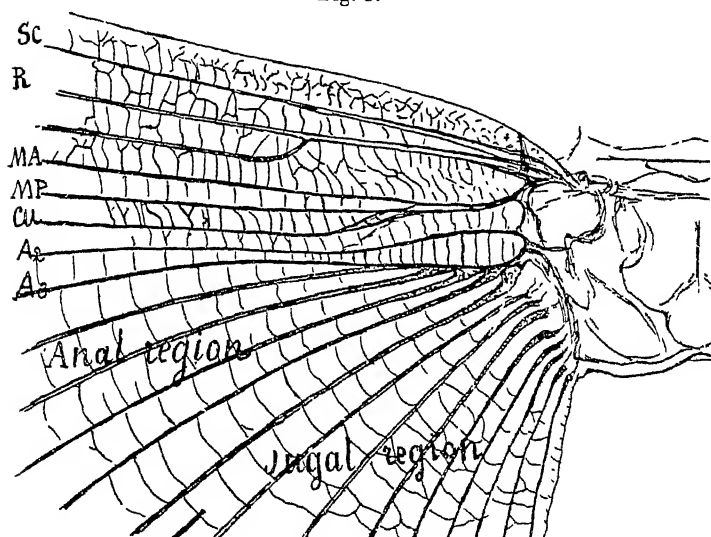
Should all the three above-mentioned genera belong to the order Phasmatodea—and I believe it to be really so,—the posterior wings must have been dilated in the anterior region, as is the case with recent Phasmatodea, although perhaps, in a slighter degree. Indeed, in Tillyard's



Aeroplana mirabilis, Till. Reproduction of Tillyard's fig. 12 (Proc. Linn. Soc. New South Wales, 1918, pl. xlv. fig. 12) with my restoration of the basal part of the ano-jugal fan (lettering somewhat altered); nervures restored represented by dotted lines.

(*loc. cit.*), reproduced here as fig. 2, we may find some indications of the existence of such an anal fan in the genus *Aeroplana*, Till. According to Tillyard's interpretation the posterior wing in *Aeroplana* is narrow and similar in shape to the anterior one; *Cu* is represented as consisting of two separate long branches, and behind *Cu*₂ existed but one anal nervure (*A*₁). We consider this nervure (*A*₁) as being *A*₂, *Cu*₂ as being *A*₁. That nervure which we designated in fig. 2 as *a-b* was considered by Tillyard as representing the basal border of the wing, two stripes *K* and *L* as "the broken off costal borders of the other pair of wings." In comparing

Fig. 3.

Basal portion of the hind wing in *Megacrania alpheus*, Westw. (recent).

this figure (12) with the hind wings of recent Phasmatodea we arrive at the conclusion that such an interpretation is not quite correct. In fig. 3 I represent the basal part of the left posterior wing in *Megacrania alpheus*, Westw. (recent). *Cu* divides in its basal portion into two branches, *Cu*₁ (which coalesces for a short distance with *MP*) and *Cu*₂, but soon both branches unite again, forming one longitudinal vein. *A*₁ has vanished here, as in the remaining recent Phasmatodea. *A*₂ in its whole configuration is very similar to the same nervure in *Aeroplana*. *A*₃ is curved in opposite direction, and forms behind in its basal portion a row of five very strong branches; immediately behind

last anal branch begins the row of jugo-radial veins (jugal region or neala). Comparison of the hind wing of *Aeroplana* with this wing shows that the nervure *a-b* and the stripes *K* and *L* in *Aeroplana* correspond exactly with the basal part of *A₃* and with its two branches in *Megacramia*. The remaining greater part of the ano-jugal fan in *Aeroplana* is broken off (fig. 2). A rather too broad space between *A₃* and *A₂* can be explained by that between both these veins a rupture resulted (in fig. 2 one can perceive the ends of the ruptured net), and *A₃* is removed a little backwards. Both branches *K* and *L* represent some of the branches of *A₃*. Thus, the hind wings in *Aeroplana* were greatly dilated in their ano-jugal region, and formed a fan. An analogous fan doubtless had existed in *Aerophasma* and *Necrophasma*, although in *Necrophasma* it had been, perhaps, less developed.

A fourth family of Phasmatodea—namely, the family Chresmodidæ, Handl., including two forms, *Chresmoda obscura*, Germar (1839), and *Chresmoda* (?) *oweni*, Westwood (1854)—has long been known from the Upper Jurassic beds of Bavaria and England. These curious insects are known chiefly by the general outline of their bodies, legs, and antennæ; but the preservation of their wings (anterior only), unfortunately, is not very satisfactory, and owing to this fact their neurulation till now has not been thoroughly elucidated. However, comparison of the elytra of these insects, as they are figured by Deichmüller* and by Handlirsch†, with those of *Aerophasma* and *Aeroplana* shows that they are similar to these in many features—namely, in the general elongated shape, in the shape of the costal region, broad in the basal portion and narrowing to the end, in *SC* running close to *R*, which is strong, in the longitudinal veins running parallel and connected by analogous cross-veins, etc. In *Chresmoda* (?) *oweni*, according to Handlirsch†, *R* was provided with *RS*, *M* was three-branched, as well as *Cu*, but the structure of *Cu* seems to me rather obscure. In *Chresmoda obscura* the nervures are parallel, but the neurulation is indistinct.

All the similarities mentioned enable us to conclude that Chresmodidæ, indeed, are allied to Aerophasmidæ and Aeroplanidæ, and thus can be considered as belonging,

* J. V. Deichmüller, in Mitt. Königl. Miner.-Geolog. u. Præhist. Mus. Dresden, Heft 7, 1886, Cassel, Seite 10, Taf. i. figg. 7-12.

† Handlirsch, Foss. Insekten, 1906-1908, S. 525, Taf. xliv. 19.

ss. Insek., S. 525, Taf. xliv. fig. 20.

Helicoid Snails from the Mohave Desert.

of the shell weakly papillose under high power, the papillæ sometimes faint and hard to make out, but generally quite strong in the interspaces between the growth-lines on the upper surface of the body-whorl and on the base just back of the aperture, being often especially evident when the shell is seen by transmitted light. Incremental striæ usually rather sharp and regular.

Periostracum thin, its colour in the freshest specimens seen a near Pinkish Buff on the spire, the base lighter. In these shells hardly more than a trace of a peripheral band is evident.

Measurements.—Caliper-measurements of ten mature specimens are as follows:—

	Maximum diameter.	Minimum diameter.	Altitude.	Diameter of umbilicus.	Number of whorls.
	mm.	mm.	mm.	mm.	
Paratype..	18.8	15.0	9.2	2.3	5 $\frac{1}{5}$
Paratype..	17.8	15.0	9.5	2.6	5 $\frac{1}{5}$
Paratype..	17.8	15.0	9.5	2.5	5 $\frac{1}{4}$
Paratype..	17.5	14.4	8.6	2.3	5
Paratype..	17.1	14.4	9.1	2.3	5
Paratype..	16.7	14.4	9.4	2.3	5 $\frac{1}{5}$
Type	16.4	13.7	8.7	2.2	5 $\frac{1}{5}$
Paratype..	15.7	13.4	8.4	2.2	5
Paratype..	15.2	13.0	8.8	1.8	5
Paratype..	15.2	12.7	8.2	2.0	4 $\frac{3}{4}$

Type.—Cat. No. 6302 of the author's collection. Paratypes No. 6303 of the same collection; others to be deposited in the collections of Mr. Allyn G. Smith and the Academy of Natural Sciences of Philadelphia.

Type-locality.—Sidewinder Mine, north end Granite Mountains, San Bernardino County, California; 66 mature and 12 immature shells, all dead and bleached; E. C. Jaeger coll.; April 11, 1927.

Remarks.—This species is unrepresented by any fresh or living material, but seems, nevertheless, amply distinct both from the foregoing species and from the smaller *graniticola*, which comes from the southern portion of the same mountain range. *Jaegeri* is a more discoid species, with a wider umbilicus, and possibly slightly larger. *Graniticola* is a thinner-shelled, much more compactly coiled form, and is notably more tumid and rounded in contour. *Crotalina*, therefore, stands in some degree between the two, but, its habitat being wholly isolated from that of *jaegeri* by the intervening desert-floor, it does not seem probable that true

The application of the whorl at the suture is very weak in this species, and old weathered shells break apart at this point with consequent ease.

The specific name selected is derived from *Crotalus*, the generic name of the sidewinder, and has reference to the type-locality.

Helminthoglypta riparia, sp. n. (Figs. 7 & 8.)

Description. — Shell thin, of moderate size, depressed-conic in outline; whorls convex, the sutural depression well marked; last whorl produced anteriorly and strongly descending just before the aperture. Aperture rounded-ovate, strongly oblique. Peristome slightly thickened, but scarcely at all everted save where it bounds and slightly indents the umbilicus. Umbilicus permeable to apex, but of only moderate width, being contained about $7\frac{3}{4}$ to 9 times in the diameter of the shell.

Fig. 7.

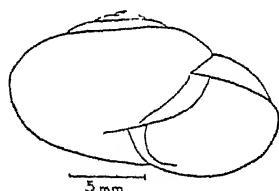
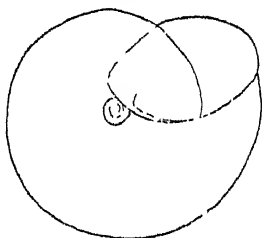


Fig. 8.



Helminthoglypta riparia, type.

Spiral sculpture wanting, but almost the entire surface of the shell distinctly and closely papillose under the high-power lens, the papillæ of the upper surface showing an evident tendency towards elongation and a ranking in forward-slanting linear series, a condition especially well marked on the earlier whorls; papillæ of base and the area within the umbilicus more granular and more irregularly disposed than those of the upper surface; all generally distinct and not confluent. Embryonic shell closely and finely wrinkly-granulose, a few forward slanting series of hyphen-shaped papillæ superimposed, which shortly evolve into the more numerous rounded papillations of the general surface.

Periostracum thin, often partly deliscent; in colour nearly a uniform Deep Olive-Buff, paling to Olive-Buff

Helicoid Snails from the Mohave Desert.

below, encircled just above the shoulder by a narrow Snuff-Brown band about 1 mm. or less wide, with only a bare hint of a lighter area above and below the band.

Measurements.—Caliper-measurements of six apparently mature specimens are as follows :—

	Maximum diameter.	Minimum diameter.	Altitude.	Diameter of umbilicus.	Number of whorls.
	mm.	mm.	mm.	mm.	
Paratype..	19.3	16.0	10.7	2.3	5 $\frac{1}{4}$
Paratype..	18.5	15.6	10.5	2.4	5 $\frac{1}{4}$
Paratype..	18.5	15.5	11.0	2.4	5 $\frac{1}{4}$
Type	17.8	15.2	10.8	1.8	5 $\frac{1}{3}$
Paratype..	17.3	14.2	10.4	2.1	5 $\frac{1}{3}$
Paratype..	16.4	14.0	9.6	2.0	5

Type.—Cat. No. 6304 of the author's collection. Paratypes No. 6305 of the same collection. Topotypes are in the collections of Mr. Emery P. Chace and the Academy of Natural Sciences of Philadelphia.

Type-locality.—Rocky outcrop on west bank of Mohave River above Oro Grande, San Bernardino County, California; 4 living adults, 2 mature dead shells, and 2 living juvenals; S. S. Berry and Floyd Taylor coll.; March 2, 1923.

A further small series of specimens, principally dead shells, was taken by Mr. and Mrs. E. P. Chace in the same locality, Dec. 24, 1920.

Remarks.—Of all the Mohavean Helminthoglyptas this one seems to approach most nearly to the original *cuyamacensis*, Pilsbry, and were it not for the widely separated habitat, might easily be regarded as but a subspecies of the latter. It differs most evidently in the more depressed form, looser coiling, smaller number of whorls, lack of spiral sculpture, and more open umbilicus. It is much more heavily papillose than any of its desert neighbours thus far brought to light, excepting possibly the larger and more narrowly umbilicate *mohaveana*, to which it is doubtless quite nearly allied.

Dead shells of this species have not been found to be anything so abundant as is usually the case with desert-snails in California, and but few were taken.

XXVII.—On a *Trichostrongylid* Nematode from the Bank Vole (*Evotomys glareolus*). By H. A. BAYLIS, M.A., D.Sc.

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AMONG the large collections of parasitic worms from field-mice and shrews recently made by Mr. C. S. Elton near Oxford, and sent to the writer for determination, there were numerous examples, collected on many different occasions, of a small *Trichostrongyle* from *Evotomys glareolus*. This appears to be a new species of *Heligmosomoides*, very closely related to the *H. polygyrus* (Dujardin) of Boulenger (1922), from *Microtus agrestis*, but differing from it in its smaller size and in other characters.

The writer has had the advantage of comparing this worm with specimens of *H. polygyrus* from *Microtus agrestis* in the same collection, and also with preparations made by Professor C. L. Boulenger from his original material of *H. polygyrus*, and very kindly presented by him to the British Museum.

Heligmosomoides glareoli, sp. n.

The worms occur in the upper part of the small intestine of the host, and are reddish during life. In the preserved condition, at least, the body is invariably thrown into a number of spiral coils, as in related species. Accurate measurements of length are therefore difficult to obtain. The males appear to be, on an average, about 3·7–3·8 mm. long, the females about 8 mm. The maximum thickness of the body is about 0·05 mm. in the male and 0·08–0·09 mm. in the female. The cuticle of the head end is somewhat expanded, the outside diameter in this region being 0·025–0·03 mm. in the male and 0·03–0·04 mm. in the female. The diameter of the head, exclusive of the cuticle, is 0·017–0·025 mm. The cuticle of the body is marked with fine transverse striations, and there are well-developed lateral alæ and about 20 (possibly more in some specimens) slight longitudinal ridges.

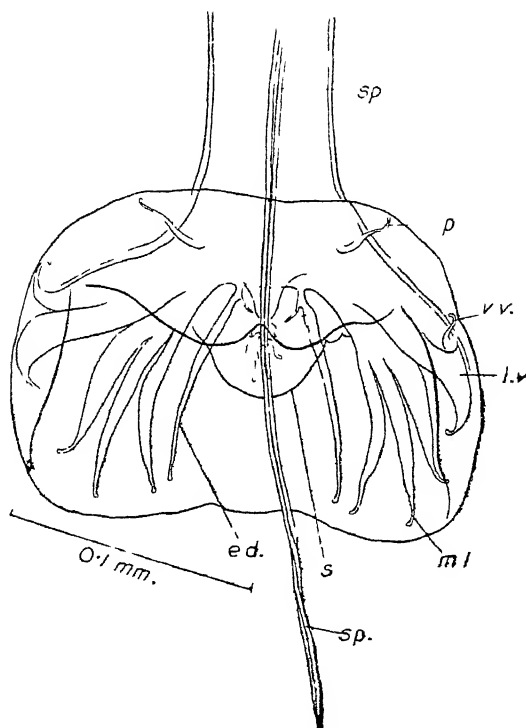
There is a very short buccal capsule, closely resembling that of *H. polygyrus* (Duj.) Boulenger. The œsophagus measures 0·45–0·47 mm. in length in the male and 0·51–0·53 mm. in the female.

The bursa of the male (fig. 1) is symmetrical, and the

a Trichostrongylid Nematode.

that in *H. polygyrus*, as figured by Boulenger, except that the postero-lateral ray of each side is not quite so markedly thinner than, or so widely separated from, the medio-lateral ray. The prebursal papillæ are long and conspicuous. The externo-dorsal rays are long and slender, and each gives off, near its base and on its inner surface, a minute, slender, accessory branch. The dorsal ray, the form of which is

Fig. 1.



Heligmosomoides glareoli. Posterior end of male; ventral view."

e.d., externo-dorsal ray; *l.v.*, latero-ventral ray; *m.l.*, medio-lateral ray; *p.*, prebursal papilla; *s.*, internal dorsal "lobe" or "post-cloacal swelling"; *sp.*, spicules; *v.v.*, ventro-ventral ray.

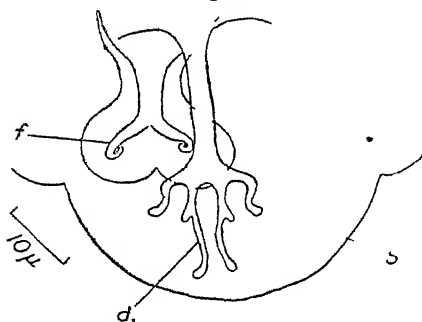
shown in fig. 2, is on the ventral surface of a membranous structure which appears to be either an accessory dorsal "lobe" within the bursa or possibly a thickening of the dorsal membrane of the bursa itself. Into this the tips of the accessory branches of the externo-dorsal rays also

On a Trichostrongylid Nematode.

the spicules are extruded, is situated on a papilla-like elevation (genital cone) whose dorsal wall is produced into a rather remarkable structure. This, so far as the writer has been able to understand it, seems to be a bilobed membranous process supported by a Y-shaped body (fig. 2, *f*), whose ends curl ventrally and have the appearance of the prongs of a pitchfork bent up almost at right angles to the handle. In a ventral view, such as fig. 1, the tips of these "prongs" are just seen on either side of the extruded spicules as refringent points. Possibly they represent a pair of post-cloacal papillæ.

The spicules are long and slender, provided, except at their extreme tips, with narrow alæ, and so closely applied

Fig. 2.



Helimosomoides glareoli. Dorsal ray and associated structures of the male, in dorsal view (slightly oblique).

d., dorsal ray; *f.*, the forked supporting structure of the process of the genital cone; *s.*, the dorsal "lobe" or "post-cloacal swelling."

to each other throughout the greater part of their length as to appear fused. They measure 0·8-1·0 mm. in length—almost twice the length of the spicules of *H. polygyrus*. No accessory piece has been observed.

The caudal end of the female is very similar to that of *H. polygyrus*. The tail is abruptly truncate, but prolonged at the tip into a minute spike. It measures (including the spike) about 0·08-0·09 mm., and the spike is 0·013-0·018 mm. long. The vulva is situated at about 0·24-0·25 mm. from the posterior extremity. The eggs measure 0·063-0·07 mm. \times 0·038-0·045 mm., and their contents are segmenting at the time of laying.

The type-specimens are deposited in the British Museum (Natural History).

Comparison with related Species.

Mention has been made in the foregoing description of a small accessory branch near the base of each externo-dorsal ray in the male. It should be noted that a similar branch, extremely slender, can be detected in favourable specimens of *H. polygyrus*, and is present both in the writer's new material and in Professor Boulenger's preparations. This branch is not described or figured either by Boulenger (1922) or by Schulz (1926), who has redescribed the species. However, in *H. travassosi*, Schulz, from *Cricetus cricetus*, a pair of very short branches is figured in this position.

H. glareoli is also not unique in the possession of the curious forked dorsal appendage of the genital cone. This structure is present, in a less highly-developed condition, in *H. polygyrus*, and is apparently well developed in *H. travassosi*, Schulz, and *H. yorkei*, Schulz, judging from that author's figures.

It is to be observed that the dorsal ray, in *H. glareoli*, lies on the ventral side of a special membranous "lobe" within the dorsal wall of the bursa. It thus seems probable that this "lobe" is the homologue of the large vesicular structure described by the writer (1926, 1927) as a "post-cloacal swelling" in *Nematospiroides dubius*.

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XXVIII.—*Les Trechus [Coleoptera, Carabidæ] de l'Everest Expedition, 1924, et Remarques sur quelques espèces de l'Himalaya.* Par le Dr. RENÉ JEANNEL.

M. G. J. ARROW, du British Museum, a bien voulu me confier l'étude des *Trechus* recueillis par le Major R. W. G. Hingston de l'Everest Expedition, 1924. Cette collection ajoute deux espèces fort intéressantes à la série des *Trechus* alpins déjà

Dr. René Jeannel sur les *Trechus*

connus de l'Himalaya*. Je profiterai de leur description pour publier quelques remarques complémentaires au sujet de quelques espèces himalayennes, qui m'ont été communiquées pour la plupart par mon excellent ami M. H. E. Andrewes, depuis la rédaction de ma 'Monographie.'

I. EVEREST EXPEDITION, 1924.

Trechus (s. str.) *indicus*, Putzeys.

Trechus indicus, Putzeys, 1870, Stett. ent. Zeit. xxxi. p. 175; Jeannel, 1927, 'L'Abeille,' xxxiii. p. 158, figs. 528-532.

Sikkim : Rongli Chu, alt. 1300 m., sur la route du Thibet par le col Jelep la, un seul exemplaire immature, févr. 1924 (*R. W. G. Hingston*).

L'espèce est largement répandue à faible altitude, sur tout le versant sud de l'Himalaya, du Punjab jusqu'au Sikkim. Dans le Kumaon, elle est représentée par une race particulière : subsp. *championi*, Jeann.

Trechus (s. str.) *imaicus*, Jeannel.

Trechus imaicus, Jeannel, 1923, Ann. & Mag. Nat. Hist. ser. 9, vol. xii. p. 421, fig. 13—type : Tonglu (*coll. H. E. Andrewes*); Jeannel, 1927, 'L'Abeille,' xxxiii. p. 161, figs. 537-539.

Sikkim : Karponang, alt. 3270 m., au nord du massif du Kangschenjunga, dans la haute vallée de la Teesta, au voisinage de la frontière du Nepal, 2 ex., avril 1924 (*R. W. G. Hingston*).

Ce *Trechus* n'était connu que par un unique individu recueilli par H. Stevens vers 3050 m. d'alt. vers la frontière du Nepal, aux environs de "Tonglu" (? Tangu). La localité Karponang semble située dans la même région.

Trechus (s. str.) *thibetanus*, sp. n.

Types : nombreux exemplaires de Tuna, sur le plateau du Thibet, vers 4600 m. d'alt. (Brit. Mus.).

Long. 2.8 à 4 mm.

Aptère. Ovale et glabre, voisin du *T. cameroni*, Jeann., du Punjab, et présentant comme lui l'aspect d'un *T. obtusus*.

Brun de poix brillant, le pronotum, la suture et le cinquième basal des élytres rougeâtres, les pièces sternales, la base du premier segment abdominal et les pattes testacés rougeâtres,

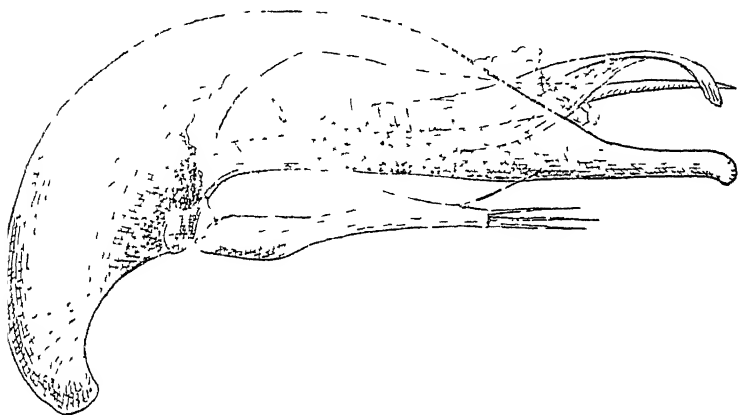
* R. Jeannel, "Les Trechiniæ de la Région Orientale" (Ann. & Mag. Nat. Hist. ser. 9, vol. xii. (1923) pp. 393-435); id. "Monographie des Trechiniæ" ('L'Abeille,' Paris, xxxiii. (1924), pp. 156-166).

les antennes brunâtres foncées avec le premier article en entier et la base des articles suivants testacés. Parfois les antennes entièrement testacées.

Tête petite, semblable à celle du *T. cameroni* (Jeannel, 1927, 'L'Abeille,' xxxiii. fig. 540); les sillons frontaux superficiels, un peu anguleux sur le vertex, les yeux peu saillants, à peine plus longs que les tempes, qui sont peu convexes. Antennes plus allongées que chez *T. cameroni*; elles atteignent le quart basal des élytres. Tous les articles sont sensiblement de même longueur, les articles moyens subcylindriques, au moins deux fois aussi longs que larges.

Pronotum transverse, d'un tiers plus large que la tête, de

Fig. 1.



Organe copulateur mâle du *Trechus tibetanus*, sp. n., face latérale gauche.
Les pièces copulatrices sont à demi évaginées.

même forme que chez *T. obtusus* d'Europe. Les côtés un peu moins arrondis en avant que chez le *T. cameroni*, nullement sinués en arrière, la base aussi large que le bord antérieur et très saillante, les angles postérieurs très obtus et émoussés. Disque peu convexe; la surface basale avec une dépression transverse en arc lisse et peu profonde, les fossettes latérales à peine indiquées.

Elytres plus allongés et bien moins convexes que chez le *T. cameroni*, ressemblant davantage à ceux des petits *T. obtusus* aptères de la forme *renati*, mais avec les épaules bien moins saillantes. La plus grande largeur des élytres vers le milieu. Bord basal transverse, les épaules arrondies, la

gouttière marginale régulière. Stries très fines et très superficielles, les quatre premières seules visibles; strie récurrente apicale rectiligne, assez longue, profonde et sulciforme, brusquement arrêtée en avant par un petit crochet.

Pattes robustes, les fémurs épais; tibias antérieurs non sillonnés sur leur face externe.

Organe copulateur de même forme générale que celui du *T. cameroni* du Punjab. Le pénis est toutefois un peu plus coudé au tiers basal et la pointe apicale est bien plus courte quoique de même forme. Deux pièces copulatrices dans le sac interne, beaucoup plus grandes que chez *T. cameroni*; elles sont cependant de même type: l'une est effilée en pointe, l'autre se termine par une tige spatulée et recourbée du côté ventral.

Mêmes caractères chétotaxiques que chez *T. cameroni*: lignes orbitaires parallèles; première soie discale au quart antérieur, deuxième soie vers le milieu de la 3^e strie; soie apicale antérieure à égale distance de la suture et du bord apical.

L'espèce est assez variable. Les grands exemplaires sont en général de coloration plus pâle, avec les antennes testacées rougeâtres, plus ou moins rembrunies. Les deux exemplaires de la localité Gantsa (alt. 4250 m.) sont particulièrement petits, à élytres courts et étroits, entièrement brunâtres et antennes très foncées.

T. tibetanus se place immédiatement auprès du *T. cameroni*, Jeann., du Punjab et a le même type d'organe copulateur que lui. Il en diffère par sa coloration, ses antennes plus longues, à articles subcylindriques et non ovales, ses élytres plus allongés et surtout moins convexes, à stries plus fines et plus superficielles, ses tibias antérieurs non sillonnés, enfin par la forme de ses pièces copulatrices. Malgré ces différences, il est probable qu'on sera amené un jour à le tenir pour une simple race du *T. cameroni*.

Ce dernier habite les régions alpines du Punjab, c'est-à-dire la partie occidentale de l'Himalaya. *T. tibetanus* est largement répandu sur le versant nord de l'Himalaya oriental. Entre les deux, la chaîne de l'Himalaya central s'étend sur plus de 1000 km. à travers le Kumaon et le Nepal. Les deux *T. cameroni* et *T. tibetanus* sont phylétiquement si proches parents qu'il est bien probable que l'immense étendue de hautes montagnes inexplorées qui les sépare se montrera peuplée de formes intermédiaires. Sans doute alors le *T. cameroni*, représenté par un certain nombre de races locales, apparaîtra-t-il comme une espèce alpine à très vaste distribution étendue à toute la chaîne himalayenne.

Position systématique.—Dans ma “ Monographie des Trechinae ” (‘ L’Abeille,’ xxxiii. p. 157), le *T. cameroni*, qui n’était alors connu que par un unique individu, a été placé dans le groupe du *T. indicus* avec d’autres espèces alpines et aptères de l’Himalaya. Les riches matériaux de l’Everest Expedition me donnent aujourd’hui la preuve que ce rapprochement était injustifié. En réalité, les *T. cameroni* et *T. tibetanus* appartiennent au groupe du *T. quadristriatus* (l. c. p. 292) et sont étroitement apparentés au *T. montanus*, Motsch., espèce répandue en Sibérie depuis la zone arctique jusqu’aux montagnes de Transbaïcalie. Ils présentent les mêmes caractères externes et aussi le même type d’organe copulateur et la même armature copulatrice formée de deux pièces bien développées. La lignée du *T. quadristriatus*, qui s’est largement répandue en Europe (*T. quadristriatus* et *T. obtusus*) se montre donc encore représentée en Asie par des espèces étroitement alliées, l’une arctique (*T. montanus* sibérien) et les autres alpines (*T. cameroni* et *T. tibetanus* largement répartis dans la chaîne de l’Himalaya). Il faut s’attendre évidemment à ce que d’autres espèces de même origine soient découvertes encore sur les hauts massifs montagneux de l’Asie centrale.

Chorologie.—Le *T. tibetanus* a été recueilli par l’Everest Expedition dans les localités suivantes :

Versant nord de l’Himalaya, plateau du Thibet : Tasam dans la Rondschar valley, alt. 3900 m., au nord du massif du Gaurizankar, juin 1924 ;—Phuse la, alt. 5400 m., col séparant les vallées Rondschar et Kyetrak, au nord du massif du Gaurizankar, juillet 1924 ;—Lamna la, alt. 4900 m., col entre les vallées Kyetrak et Rongbuk, au nord du massif du mont Everest, juin 1924 ;—Tashidzom, alt. 4750 m., dans le Pharuk, au nord du massif du mont Everest ;—Kang la, alt. 5550 m., col dans le massif du Walung, mai 1924 ;—Pangle, alt. 4900 m., dans la même région, mai 1924 ;—Tuna, alt. 4500 m., sur le plateau du Thibet, au nord du mont Chomolhari, avril 1924, nombreux exemplaires (types) ;—Gantsa, alt. 4300 m., sans doute aux environs de Tuna, avril 1924.

Versant sud de l’Himalaya. Thibet : vallée du Chumbi, alt. 3600 m., à l’est du Sikkim, avril 1924.—Sikkim : Tangu, alt. 4500 m., dans le haut bassin de la Teesta, versant est du massif du Kangchenjunga, avril 1924.

Une cinquantaine d’exemplaires de ces diverses localités, recueillis par le Major R. W. G. Hingston. Comme on le voit l’espèce se trouve entre 3500 et 5500 m. d’altitude.

Le *Plocamotrechus kenyensis*, Jeann., qui vit sur le mont Kénia, en Afrique orientale, à 4500 m. d’altitude, était

jusqu'à présent l'espèce de Carabique recueillie à l'altitude la plus élevée. Le *T. tibetanus*, trouvé jusqu'à 5500 m. au Kang-la, augmente donc de 1000 m. encore l'altitude maxima compatible avec la vie des Coléoptères. Il semble que cette altitude de 5500 m. doive être une limite qui ne sera guère dépassée.

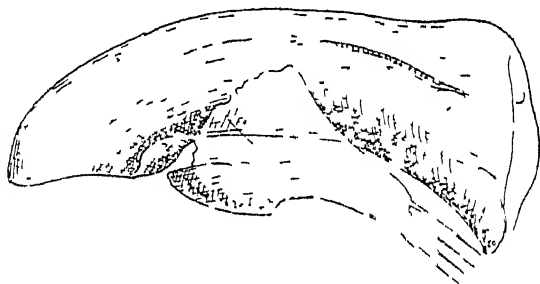
Trechus hingstoni, sp. n.

Types : plusieurs exemplaires de Guatang (Brit. Mus.).

Long. 3.5 à 4 mm. Aptère. Court et convexe, présentant un peu l'aspect du *T. striatulus*, Putz., des Carpathes. Brun de poix très brillant, avec la base du pronotum, celle des élytres et leur suture rougeâtres, les pièces sternales et les pattes testacées, les antennes testacées rougeâtres, rembrunies au sommet.

Tête petite, transverse, plus étroite que le pronotum, les

Fig. 2



Organe copulateur mâle du *Trechus hingstoni*, sp. n., face latérale gauche.

sillons frontaux très profonds, réguliers, non anguleux sur le vertex ; les yeux saillants, nettement plus longs que les tempes, celles-ci très peu convexes. Antennes courtes, atteignant à peine le cinquième basal des élytres, les articles moyens ovalaires, à peine une fois et demie aussi longs que larges.

Pronotum grand, un peu transverse, sa base presque aussi large que le bord antérieur, rectiligne dans l'ensemble, mais avec la partie médiane un peu saillante sur le pédoncule mésothoracique. Côtés du pronotum bien arrondis en avant, nettement sinués en arrière, avant les angles postérieurs qui sont assez grands, vifs et rigoureusement droits. Disque assez convexe, la surface basale peu déprimée, avec un sillon transverse en arc peu apparent, les fossettes basales grandes et profondes.

Elytres ovales et convexes, courts, atténués au sommet. La gouttière marginale large et régulière, les épaules arrondies mais un peu saillantes. Les trois premières stries entières et profondes, avec les interstries un peu convexes, les deux stries suivantes très superficielles, mais visibles, les autres tout à fait effacées. Strie récurrente apicale profonde et longue, cessant en avant peu à peu sur l'extrémité apicale de la 5^e strie sans déviation ni crochet.

Pattes courtes, les fémurs épais; tibias antérieurs faiblement sillonnés sur leur face externe.

Organe copulateur très petit, très court et épaissi à l'apex, présentant une déformation analogue à celle du *T. priapus*, Dan., des monts Dinariques. La partie basale du pénis est peu infléchie, étroite et l'orifice basal est ouvert en biseau. Partie apicale du pénis au contraire élargie peu à peu, le bec apical court et mousse, sans crochet, l'orifice apical terminal, ouvert dans un plan presque perpendiculaire à l'axe du pénis. Styles larges, armés de 4 soies étalées. Sac interne sans revêtement d'écaillés. Pas de pièce copulatrice évaginable libre dans l'intérieur du sac; mais la paroi dorsale du sac est chitinisée sur plus du tiers de sa longueur. Cette partie chitinisée du sac forme une sorte de plaque dorsale dont l'extrémité apicale est légèrement saillante.

Chétotaxie normale. Lignes orbitaires parallèles. Soie discale antérieure vers le tiers, deuxième soie vers le milieu de la 3^e strie. Soie apicale antérieure plus rapprochée de la suture que du bord apical. La crosse apicale de la 2^e strie est très longue; la 2^e strie s'écarte peu à peu de la 1^{re}, de sorte que le 2^e interstrie est très large dans sa partie apicale. Par suite la soie apicale antérieure se trouve particulièrement éloignée de l'apex.

Cette espèce, dont l'aspect extérieur rappelle beaucoup celui des espèces montagnardes de l'Europe, est tout à fait isolée des autres espèces himalayennes connues.

Chorologie.—Sikkim: Gnatang, alt. 3900 m., localité située près de la frontière du Thibet, au pied du col Jelep la, dans l'est de la province, 12 ex., mars 1924 (R. W. G. Hingston).

II. REMARQUES SUR QUELQUES ESPÈCES DE L'HIMALAYA.

Trechus (s. str.) *macrops*, Jeannel, 1927, L'Abeille, xxxiii. p. 160, fig. 533-536.

Ce *Trechus* a été décrit sur un individu unique étiqueté "Yun-Nan," sans autre indication. C'est une espèce ailée,

apparentée au *T. indicus* du versant méridional de l'Himalaya et qui semblait le remplacer dans le Yun-Nan. Or, j'ai tout lieu de croire aujourd'hui que cette indication de provenance du type de mon *T. macrops* est fausse.

Un deuxième exemplaire mâle, parfaitement conforme au type par ses caractères externes et par ceux de son organe copulateur, a été recueilli dans le Kashmir, à Sonemarg, dans les montagnes à l'est du lac Wular, par G. Babault, en août 1914, c'est-à-dire dans l'extrémité occidentale de la grande chaîne himalayenne. Il serait bien invraisemblable que le *T. macrops* existe à la fois dans le Kashmir et au Yun-Nan, de part et d'autre de l'aire géographique du *T. indicus*. L'indication de provenance du type de mon espèce doit sans doute être le fait d'une erreur d'étiquetage et la seule localité certaine d'où le *T. macrops* puisse être cité, est celle du Kashmir.

Trechus (s. str.) *indicus*, subsp. *macroderus*, nov.

Type: une femelle de Keshtewar (coll. H. E. Andrewes).

Race brachyptère, de coloration rougeâtre brillant uniforme. Forme générale de la race *championi*, Jeann., mais encore plus convexe, avec le pronotum encore plus grand et surtout bien plus finement rebordé.

Tête de même forme que chez *T. indicus*, les yeux moins saillants et plus courts, à peine trois fois aussi longs que les tempes; les antennes plus courtes et plus épaisses. Pronotum très grand, très convexe, presque aussi large que les élytres et plus large que long. La base plus étroite que le sommet, comme chez la race *championi*, les côtés arrondis en avant, non sinués en arrière, la base rectiligne, les angles postérieurs obtus. Gouttière marginale du pronotum bien plus étroite, même en arrière, auprès des angles postérieurs; les fossettes basales plus superficielles que chez le *T. indicus* typique.

Elytres allongés, très convexes, de même forme que chez la race *championi*, mais avec les stries moins profondes. Les trois premières stries seules sont profondes, la quatrième très superficielle, les autres effacées. Tibias antérieurs sillonnés.

Mêmes caractères chétotaxiques que chez le *T. indicus* typique.

Chorologie.—Inde, Punjab: Keshtewar (coll. H. E. Andrewes).

Quoique le mâle soit inconnu, il n'est pas douteux que ce *Trechus* appartient à une race spéciale, après, du *T. indicus*. Cette race est particulièrement remarquable par l'étroitesse

de la gouttière marginale du pronotum. La grande taille relative de son pronotum, la réduction des yeux et l'épaississement des antennes sont des caractères corrélatifs de l'atrophie des ailes.

Trechus (s. str.) *cameroni*, Jeannel, 1923, Ann. & Mag. Nat. Hist. ser. 9, vol. xii. p. 422, fig. 14 ; type : Narkanda (Brit. Mus.).—Jeannel, 1927, 'L'Abeille,' xxxiii. p. 162, figs. 540-543.

M. H. E. Andrewes me communique cette espèce des localités suivantes :

Inde, Punjab : Talratach, alt. 3250 m., Tharoch, Simla (C. F. C. Beeson) ;—col Jalori, alt. 3550 m., Seraj (H. G. Champion) ;—col de Rotang, alt. 3850 m., près de Koksii, dans le Lahoul (coll. H. E. Andrewes).—Kashmir, un exemplaire (Rost, 1905).

L'espèce était déjà connue de Narkanda (sans doute dans le Gahrwal) et de Kotgarh, aux environs de Simla. Les localités nouvelles étendent l'aire de distribution de l'espèce vers le nord-ouest jusque dans le Kashmir.

Trechus (s. str.) *cameroni*, subsp. *bistriatus*, nov.

Type : un mâle des environs du lac Kareri (coll. R. Jeannel).

Bien différent de tous les *T. cameroni* que j'ai pu examiner par ses élytres plus allongés et moins convexes, à stries presque totalement effacées. Les deux premières stries seules sont visibles, fines et superficielles, les premiers interstries plans. Chez le *T. cameroni* typique les quatre ou cinq premières stries sont visibles, profondes et séparées par des interstries convexes.

Même coloration que chez *T. cameroni* ; tête et pronotum identiques ; tibias antérieurs très faiblement sillonnés. Organe copulateur semblable à celui de la forme typique, avec la même armature copulatrice.

Un seul mâle reçu par M. P. A. Chappuis dans un lot de mousses qui lui a été envoyé afin d'y rechercher des Copépodes. Ces mousses avaient été recueillies aux environs du lac Kareri, près de Kangra, dans le Punjab, en juin 1926 (S. L. Hora).

Le district de Kangra se trouve sur la bordure de l'Himalaya, dans le nord-est du Punjab, sur la frontière du Kashmir.

On the Chloropid Genus Epimadiza, Becker.

XXIX.—*The Chloropid Genus Epimadiza, Becker (Diptera).*
By J. R. MALLON.

IN a small shipment of reared Diptera received from Mr. A. Guthbertson, Junior Entomologist, Agriculture Laboratory, Salisbury, S. Rhodesia, for identification, there are three specimens of a species of the genus *Epimadiza*, Becker, which provide the first indication of the larval habits of the genus. It is possible that the species may be of economic importance, but I deal in the present paper merely with the taxonomic features of the genus. Becker distinguished it from *Oscinella*, Becker (= *Botanobia*, Lioy), and *Approximetopsis*, Becker, by the thickened fore-femora with their distinct postero-ventral bristles. I note also that there is no flexure of the fifth wing-vein on its penultimate section, there are in the species before me only two notopleural bristles (1+1), the postvertical bristles are fully as long as the outer pair of verticals, and the inner verticals are much shorter and barely longer than the short ocellars.

I designate as the genotype *Oscinis rugosa*, de Meijere, the first species included in the genus by Becker.

Below I present a key for the identification of the species, but most of the data are obtained from descriptions, so that care must be used in applying it to material. It is possible that there are some synonyms, but only a careful comparison of type-specimens will determine this. I will deposit the type-specimen of *hirta* in the British Museum.

Key to the Species.

- | | |
|---------------------------------------------------------------------------------------------------------------------------|-----------------------------|
| 1. Halteres yellow | 2. |
| Halteres black or fuscous | 3. |
| 2. Hind femora black, their tips yellow; tibiae and tarsi of mid and hind legs yellow | <i>nitida</i> , Lamb. |
| Hind femora yellow, blackened on apical halves. | <i>albivervis</i> , Becker. |
| 3. Small species, about 1.5 mm. in length; base of abdomen not pale above; fore femora yellowish, paler than tibiae | <i>rugosa</i> , de Meijere. |
| Larger species, averaging 2.5 mm. in length; base of abdomen pale above; fore femora not paler than fore tibiae | 4. |
| 4. Thoracic dorsum practically bare | <i>nigra</i> , Lamb. |
| Thoracic dorsum with quite dense short black hairs | <i>hirta</i> , sp. n. |

Epimadiza hirta, sp. n.

Female.—This species is very similar to the description of *nigra*, Lamb, being glossy black, with pale basal tergite to

On a new Cicada from Arabia.

abdomen, and the wing-veins entirely pale. The face and cheeks are, however, but indistinctly yellow, the dorsum of the thorax is quite densely and coarsely punctate, and in each puncture there is a short decumbent blackish hair, the disc of scutellum is less obviously punctate, and the longest pair of marginal bristles (at apex) are situated on very slightly raised bases. In all three specimens before me the basal abdominal tergite and the central anterior part of second are white, the fore coxæ, bases of fore tibiæ, apices of mid and hind tibiæ, and basal three or four segments of fore and hind tarsi are yellowish. The cheek is not as high as width of third antennal segment, the frontal triangle is but poorly defined, about half the width of vertex, and extends to a little over middle of frons. The basal section of second wing-vein lies much closer to first vein than is shown in Lamb's figure of the wing of *nigra*.

Length 2.5 mm.

Type and two paratypes, Salisbury, S. Rhodesia, Department of Agriculture no. 1525, reared from gladiolus.

There is a possibility that the larvæ affect only injured bulbs, as do some other genera of this family.

XXX.—*A new Cicada from Arabia.* By J. G. MYERS,
Sc.D., Imperial Bureau of Entomology.

Platypleura arabica, sp. n.

Form short and stout, widest at middle of pronotum. Head with eyes wider than base of mesonotum. Frons with the cross-striæ regular and well defined; subcircular, as wide as long. Clypeus strongly keeled. Rostrum reaching posterior margin of second sternite. Opercula of male rounded, reaching nearly to middle of third sternite. Hypandrium widely boat-shaped, somewhat truncate apically. Aedeagus simple, tubular, as figured. Eighth sternite of female long, slightly keeled, rounded postero-laterally, with a deep but narrow median indentation. Tegmina completely hyaline, the veins pale stramineous to the nodal line, thereafter fuscous. Apical margin straight. Hind wings with basal third smoky, then an irregular and indistinct milky zone, thence hyaline; veins basally fuscous, passing into stramineous in distal half. Border of hind wing wide, about one-sixth length. Usually seven preapical spines on h

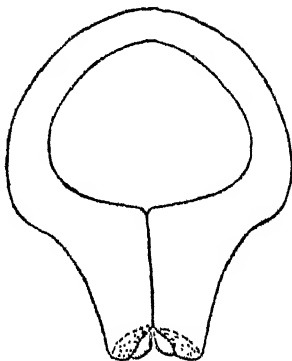
tibia (holotype has only one on right, and allotype has eight on one leg).

In fresh examples (holotype and allotype) abundantly pruinose, especially on sides of abdomen, veins of tegmen up to or even past nodal line, and whole under surface of head and body. Elsewhere, save on salient points, the same appearance is simulated by decumbent white pubescence.

Fig. 1.



Fig. 2.



Platyleura arabica, sp. n.

Fig. 1.—Aedeagus, lateral view.

Fig. 2.—Tenth segment (eleventh removed), caudal view.

General colour pale yellowish brown with black markings. Abdomen, save tymbal covers, black beneath the patches of pruinosity, with brownish segmental margins, and with some decumbent white pubescence dorso-laterally, extending right across on the anterior margins of segments ii. and iii.

new Cicada from Arabia.

Upper third of frons blackish, with two contiguous or confluent yellowish spots; rest pale, the cross-ridges darker. A straight-edged black bar on vertex connecting eyes but interrupted by ocelli. Pronotum with sulci and two median impressed dots on anterior margin of hind border black, rest pale. Mesonotum with an outer and an inner pair of well-defined obconical black marks, a median lance-shaped mark, and two round spots, one at each anterior angle of the cruciform elevation; rest of mesonotum pale; both black and pale areas strewn with white pubescence.

Dimensions in mm. (first figure male, second female):—

Length to tip of last tergite 26·2, 25·1; length of head in dorsal view 1·5, 1·7; width between eyes 7·0, 7·0; length of pronotum 5·0, 5·0; length of mesonotum 7·1, 6·4; length of tegmen 34·0, 35·4; greatest width of tegmen 12·0, 12·3.

Holotype, *allotype*, Wadi Samaiyil, Oman, Arabia (*V. H. M. Dowson*), 15. vi. 27.

Paratypes. There are also in the British Museum one male (collector unknown) and a male and female (*Dr. Jayakar*), all three from Muscat. These three are old specimens and lack both the pruinosity and the pubescence, but are otherwise practically identical. Possibly they have been in alcohol.

All material known to me is thus in the British Museum. For the fresh material on which this, the only known Arabian *Platypleura*, is based, I am indebted to Dr. P. A. Buxton.

P. arabica is evidently the Arabian representative of a deserticolous group of species, of very similar facies. *P. mackinmoni*, Dist., from Dehra Dun, North India, is closely related, but, among other differences, the pronotal expansions are more acute, with the posterior edge slightly incurved, whereas in *arabica* it is straight.

P. testacea (Walk.) from India (locality unknown) also belongs to this group. The three old specimens here referred to *P. arabica* were placed by Distant incorrectly under *P. testacea*, which is really represented in the British Museum now by the type only—a female. The locality—Muscat—given for *P. testacea* in the Distant 'Catalogue' (1906, p. 8) is thus incorrect. This species is altogether paler than either *arabica* or *mackinmoni*, with much greyish pubescence on the abdomen. It has the acute pronotal expansions of *mackinmoni*, but their posterior edge is straight as in the species here described as new.

With regard to the haunts and habits of this interesting insect, Mr. Dowson has written to Dr. Buxton as follows:—

"The Wireless Insect buzzes upside down on the underside

Sur une nouvelle espèce de Bolboceras du Soudan.

of a small branch of any of the trees of the region. I saw them on palms; but the commonest of the trees on which they were to be found were undoubtedly the common, leguminous, thorny small tree which was such a constant feature of the Uman landscape. This tree in general appearance and situation closely resembles *Acacia arabica*, but, because of the coiled pods and other features, I do not think it is an *Acacia* at all. . . . It is the *sumar* of the natives."

Dr. R. J. D. Graham, of the Royal Botanic Gardens, Edinburgh, has kindly informed us that *sumar* appears to be *Acacia Seyal*.

XXXI.—*Une nouvelle espèce de Bolboceras du Soudan.*

Par A. BOUCOMONT.

Bolboceras niloticus, sp. n.

Testaceus rubescens nitidus, antennis testaceis. Labro integro carinato, clypeo transversim carinato, vertice carina transversa elongata inter oculos armato; fronte punctis magnis confluentibus gradatim antice minoribus notata, vertice tenuiter et sparsim punctato, oculorum cantho parum prominulo. Prothorace antice retuso quadrituberculato, parte retusa post oculos bicavata, tuberculis mediis triangulatis contiguus supra planis, externis magis prominentibus dentiformibus latere externo fovearum sitis; margine antica non dentata, basi sinuata marginata, sulco medio obsoleto nonnullis punctis notato; angulis anticis fere rectis apice aculeatis; lateribus crebre punctatis disco lævi. Elytrorum striis crebre punctatis punctis interstitia incidentibus, secunda apice abbreviata, interstitiis subconvexis lævibus primo fere tam lato quam duobus sequentibus conjunctim. Tibiis anticis sexdentatis.

Long. 8–11 mm.

Soudan anglo-égyptien, Medani (*H. W. Bedford*).

Espèce caractérisée par l'armature du thorax et par la largeur du premier intervalle des élytres; diffère de *B. gaujani*, Fairm., par l'absence de fovéole derrière les dents médianes du thorax, ces deux dents plates en dessus et contiguës; diffère de *B. spurium*, Péring., par la taille beaucoup plus petite et la tête avec deux carènes; de *B. auspicatum*, Péring., par la carène de l'épistome rectiligne et le lobe médian du thorax bidenté.

XXXII.—Nouveaux Bruchidæ. Par M. PIC.

Pachymerus ritchiei, sp. n.

Oblongus, antice et postice attenuatus, nitidus, pro parte griseo-pubescent, rufus; oculis, antennis (articulis 2 primis exceptis) et abdomine pro maiore parte nigris. Capite parum elongato, inter oculos carinato, oculis maximis, approximatis; antennis elongatis, articulo 2 minuto, 3-5 sat elongatis, apice angulatis, sequentibus valde transversis et pectinatis; thorace brevi et parum lato; antice attenuato, lateraliter fere recto, subalutaceo, mediocre sat sparse punctato, pro parte denudato; scutello parvo, griseo-pubescente; elytris thorace sat latioribus, parum elongatis, postice attenuatis, humeris rotundatis, minute striatis, pro parte glabris et maculis obscuris diversis ornatis; pygidio minute, rufo, griseo-pubescente; infra corpore pro parte rufo, pro parte nigro, sat uniformiter griseo-pubescente; pedibus rufis, 4 anticis gracilibus, femoribus posticis infra piceo-notatis, robustissimis et multidentatis, tibiis valde arcuatis.

Long. 5 mm.

Voisin de *P. sibutensis*, Pic, en diffère nettement par sa forme plus courte et relativement trapue.

TANGANYIKA: Morogoro, xii. 1923 (*A. H. Ritchie*).

Bruchus boxi, sp. n.

Subovatus, pro parte opacus, diverse pubescens, niger, elytris apice rubris, articulis 1-5 et 11 antennarum, pedibus 4 anticis tarsisque posticis testaceis, femoribus intermediis pro parte brunneis. Capite parum elongato, dense punctato, oculis magnis; antennis sat brevibus, articulis 2-4 elongatis, 5 latiore, 6-10 plus minusve transversis aut pectinatis; thorace dense ruguloso-punctato, capaco, nigro, lateraliter sat dense luteo-pubescente, illo sat breve, antice valde attenuato, lateraliter subsinuato, medio postice gibbuloso; scutello parvo; elytris thorace paulo latioribus, brevibus, humeris rotundatis, parum nitidis, striatis, ad suturam paulo luteo-pubescentibus, multo et diverse albo-maculatis aut lineolatis; infra corpore nigro, pro parte albo-pubescente; pygidio albo, nigro binotato; pedibus 4 anticis gracilibus, posticis validis et brevibus, femoribus minute dentatis, tibiis posticis ad basin paulo curvatis, carinatis, apice dentatis, articulo 1^o tarsorum curvato.

Long. 2 mm.

Jolie petite espèce, voisine de *B. hinnulus*, Fhs., mais ventre, pygidium et tibias postérieurs noirs, élytres avec, en avant de la partie apicale rouge, une sorte de bande transversale faite de macules grises juxtaposées.

KENYA COLONY: Kabete, 13. ix. 1921 (*H. E. Box*).

Monsieur M. Pic sur quelques nouveaux Bruchidae.

Bruchus maculatithorax, sp. n.*.

Oblongus, antice attenuatus, opacus, nigro-piceus aliquot brunneus, dense albo-pubescent, supra nigro-maculatus, membris testaceis. Capite nigro, aliquot rufescente, brevis, dense albo-pubescent, oculis valde incisus, fere divisus; antennis testaceis, brevibus, apice paulo incrassatis; thorace sat elongato, antice valde attenuato, medio convexo, dense griseo-pubescent, nigro 4-maculato; scutello paulo elongato, dense pubescent; elytris thorace parum distincte latioribus, brevibus, minute et parum distincte striatis, griseo pubescentibus, ad basin, ad medium et apice diverse nigro-maculatis aut subfasciatis; infra corpore et pygidio dense pubescentibus; pedibus testaceis, pro parte dense pubescentibus, posticis sat validis, femoribus indentatis, tibiis fere rectis.

Var. Pro parte luteo-pubescent.

Long. 2.5 mm.

Espèce des plus distinctes par son revêtement pubescent dense, ne laissant que quelques macules foncées sur les élytres et le prothorax, ainsi que par la forme des yeux.

INDIA: Gonda, Janakpur, U.P., 14. iv. 1911 (*R. S. Troup*).

Spermophagus basicornis, sp. n.

Subquadrato-ovatus; parum nitidus, griseo aut luteo sat uniformiter pubescent, niger, articulis 2 primis antennarum testaceis. Capite parum brevis; antennis elongatis, subfiliformibus, articulo 2° brevis, 3° paulo longiore, 4° et sequentibus diverso elongatis et apice infra angustatis; thorace brevis et lato, antice subarcuato, minute punctato; elytris thorace non latioribus, sat brevibus, striatis, minute punctatis; pygidio fortiter punctato, uniformiter griseo-pubescent; infra corpore pro parte densius pubescent; pedibus nigris, spinis tiliarum rufis.

Long. 2 mm.

Cette petite espèce se distingue, à première vue, des autres foncées du genre, par les antennes non entièrement noires.

MOZAMBIQUE: Villa Bocage, iii.-iv. 1914.

Bruchus (Acanthocelides) albus, sp. n.

Oblongo-ovatus, opacus, rufus, dense albo-pubescent, membris testaceis; capite longissimo, rufo, paulo pubescent, ruguloso-punctato, medio carinato, oculis nigris, validis, paulo prominulis, valde emarginatis; antennis validis, articulis 2 et 3 minutis,

* Cette espèce figure aussi dans la collection Pic, ainsi que *S. basicornis*.

Sur quelques espèces nouvelles de Coccinellides.

4 triangulare, 5 et sequentibus plus minusve longe dentatis; thorace parum elongato, obconico, antice valde angustato, angulis posticis valde prominulis, medio subconvexo, lateraliter paulo compresso, in disco sulcatulo, sat fortiter punctato, fere uniformiter albo-pubescente; scutello parvo; elytris thorace postice paulo latoribus, brevibus, lateraliter subarcuatis, ad basin medio minuto tuberculatis, humeris rotundatis, sat prominulis, minute striatis, dense albo-pubescentibus, lateraliter pro parte denudatis; pygidio horizontali, valido, dense uniformiter albo-pubescente, supra medio breviter sulcato; pedibus 4 anticis gracilibus, posticis validis, femoribus apice tridentatis dento prima longiore, tibiis carinatis, apice intus longe spinosis.

Long. 3 mm.

SOUDAN ANGLAIS.

Par sa forme voisin de *B. atrolineatus*, Pic, en diffère, en plus du revêtement blanc uniforme, par la tête plus longue derrière les yeux, le prothorax plus égal en dessus, les élytres à stries à peine indiquées, les cuisses postérieures plus fortes.

Bruchus poupillieri diversiventris, subsp. n.*.

Oblongo-elongatus, nitidus, griseo pro parte dense pubescens, rufo-testaceus, capite pectoreque nigris, thorace variabili, nigro aut diverse rufo-testaceo, oculis maximis; thorace plus minusve brevi, sat lato, antice paulo attenuato, lobo medio paulo inciso aut supra depresso; membris testaceis; antennis crassioribus ♂, femoribus posticis parum crassis, inermis.

Long. 2 mm.

SOUDAN ANGLAIS.

Semble différer de *B. poupillieri*, All., par le prothorax plus robuste, moins conique, à lobe médian impressionné, la tête très large chez le ♂, enfin, chez les trois exemplaires examinés, par la coloration testacée de l'abdomen.

XXXIII.—*Description de quelques espèces nouvelles de Coccinellides.* Par le Dr. A. SICARD.

Scymnus (Nephus) bicolor, sp. n.

Breviter ovatus, niger, nitidus, pube tenui grisea sat dense vestitus; capite rufo (♂) in medio leviter infuscato (♀), abdomine nigro, apice anguste dilutiore, lateribus prothoracis fulvis (♂) vel nigris (♀). Pedibus, in utroque sexu, rufo-flavis. Laminis

abdominalibus haud integris, linea femorali $\frac{3}{4}$ longitudinis segmenti attingente, extus abbreviata. Prosterno haud carinato, quadrato-elongato.
Long. 1.9-2.0 mm.

En ovale court, médiocrement convexe, brillant, à pubescence grisâtre, avec la tête et les côtés du corselet roux (♂) ou la première rembrunie au milieu et les seconds concolores (♀). Pieds d'un roux vif dans les deux sexes. Dessous noir avec l'extrémité abdominale parfois étroitement plus claire. Plaques abdominales incomplètes. La ligne femorale, d'abord en ligne courbe jusqu'aux trois quarts de la longueur du premier segment abdominal, se dirige ensuite obliquement vers le bord latéral dont elle reste éloignée. Le prosternum est plan, en quadrilatère allongé.

PANAMA.

Je n'ai trouvé aucune description correspondant au signalement de cet insecte dans la 'Biologia Centrali-Americana' de Gorham, et elle ne peut être assimilée à aucune de celles décrites de l'Amérique centrale par M. Casey. Son système de coloration la rapproche du *Scymnus* (*Pullus*) *auritulus*, Muls., dont la distinguent facilement sa forme générale moins parallèle et plus arrondie, la tache latérale rousse du corselet plus atténuée en arrière, la tête rousse dans les deux sexes, seulement rembrunie au milieu chez la ♀, ses élytres à extrémité concolore, son ventre noir, et enfin son prosternum non caréné et le dessin de ses plaques abdominales qui la font placer dans un sous-genre différent.

PHARELLUS, gen. nov.

Corpus parvum, breviter ovatum, postice attenuatum; supra pilis erectis vestitum. Caput inclinatum. Antennæ perbreves, 11-articulatæ (?), clava ovoidea triarticulata, palpi maxillares crassi, articulo ultimo conico; prosternum quadratum, curtulum, inclinatum, mesosternum transversale, metasternum grande, convexum. Pedes breves, femoribus sulcatis, tarsis crassioribus, triarticulatis. Epipleuris latis, in medio abrupte dilatatis usque ad $\frac{2}{3}$ longitudinis elytrorum prolongatis.

Très petit, en ovale court et atténué en arrière. Tête inclinée sur un prosternum très court et oblique (comme chez certains *Rodolia*). Antennes courtes, m'ayant paru formées de 11 articles, à massue ovoïde, arrondie surtout en dedans, de trois articles dont le troisième plus long que chacun des deux autres atténué et arrondi au sommet. Palpes maxillaires courts, gros, à dernier article conique. Prosternum très court, incliné. Mesosternum transversal, droit à sa partie

quelques espèces nouvelles de Coccinellides.

antérieure, échancré en arc de cercle large en arrière pour recevoir l'extrémité antérieure du métasternum. Ce dernier grand, convexe, sans fossettes. Abdomen de six arceaux, le premier plus grand que chacun des trois suivants qui sont subégaux entr'eux, le cinquième aussi long que le premier, le sixième étroit, ogival, petit.

Tête enfoncée dans le prothorax jusqu'au bord postérieur des yeux; ceux-ci petits, arrondis, saillants; front convexe; épistome droit à sa partie antérieure, labre allongé, rétréci en avant et arrondi. Prothorax à côtés convergents en avant, régulièrement convexe, en ogive large et non sinué à la base qui est finement rebordée. Elytres à peine plus larges que le prothorax à leur base, régulièrement arrondis et élargis de l'angle huméral jusqu'au tiers antérieur, puis régulièrement atténués jusqu'à l'apex qui est arrondi. Epipleures larges, formant un repli à la partie externe des elytres, concaves, d'abord parallèles jusqu'au tiers, s'élargissant assez brusquement en cet endroit et formant un renflement arrondi, atténué en arrière jusqu'aux deux tiers de la longueur où les deux côtés se confondent pour former une lame unique. Pieds courts, fémurs sillonnés, ne dépassant pas le bord externe elytral, tarses larges, ongles petits (appendiculés?). Dessus couvert de poils hérissés dirigés d'arrière en avant sur le corselet et d'avant en arrière sur les élytres. Hanches antérieures et intermédiaires assez rapprochées, les postérieures très écartées.

Pharellus minutissimus, sp. n.

Supra piceus, prothorace dilutior, subtus brunneus, labro, pedibus, palpis antennisque testaceis.

Long. 0.8 mm.

De très petite taille, inférieure à 1 millimètre. En ovale court, atténué en arrière. En dessus d'un brun de poix, plus clair sur le corselet, avec le labre, les antennes et les palpes testacés. Prothorax lisse. Ecusson bien visible, triangulaire. Elytres à repli externe bien marqué, à points gros, écartés, superficiels, calus huméral marqué. Epipleures foncées.

Dessous brunâtre, plus clair que le dessus. Premier arceau ventral deux fois plus long que chacun des trois suivants. Plaques abdominales grandes, n'atteignant pas tout à fait le bord postérieur de l'arceau en arc de cercle plus convexe en dehors qu'en dedans. Mésosternum lisse; métasternum couvert de gros points varioliques presque contigus.

JAVA.

XXXIV.—*Some Rarities from Abyssinia, with the Description of a new Mole-Rat (Tachyoryctes), and a new Arvicanthus.* By OLDFIELD THOMAS.

THE National Museum has received from Major R. E. Cheesman, R.E., the fine collection of Mammals made by him in Abyssinia, mostly in the region just to the south of Lake Tana. In the collection there are a number of rarities, several only hitherto known by one or two examples. Such are *Mops ventralis*, Heugl., *Atilax paludinosus mitis*, Thos., *Ictonyx striatus shoæ*, Thos., *Acomys albigena*, Heugl., *Desmomys harringtoni*, Thos.*, *Muriculus imberbis*, Rüpp., *Leggada bella gallarum*, Thos., and *Lepus fagani*, Thos. There is also a fine series of a *Tachyoryctes* which does not seem to be referable to either of Rüppell's two species, *T. macrocephalus* and *T. splendens*, and may be described as follows:—

Tachyoryctes cheesmani, sp. n.

7 ♂, 17 ♀. Dangila, 6000–7000'.

♂ ♀. Fatan R., Big Abbai, 100 miles S. of Lake, 600'.

♂. Amanuel, 100 miles S. of Lake, 7600'.

♂. Wanbera town, Big Abbai, 130 miles S.W. of Lake, 8000'.

3 ♀. Debra Markos, 100 miles S. of Lake, 8000'.

Allied to *T. splendens*, but decidedly larger.

Colour and other external characters about as in *splendens*, of the usual dark bay colour.

Size uniformly larger than in *splendens*, of which the British Museum possesses a co-typical example, precisely matching that figured by Rüppell. Zygomatic widely expanded, more so than in the majority of the East African forms. Sagittal and lambdoid crests early and strongly developed, even in females when adult. Occipital slope about as in *splendens*, more approaching the vertical than in the East African forms, among which types as extremely sloped as *T. spalacinus* occur. Bullæ decidedly larger than in *splendens* or in most of the E. African species.

Incisors stout and heavy, well projected forwards, darker in colour than in the available specimens of *splendens*.

Dimensions of the type:—

Head and body 200 mm.; tail 67; hind foot 30; ear 17.

* I do not now think that Rüppell's *Mus dembeensis* is a *Desmomys* at all, as was formerly supposed to be the case. The "straffen haaren," "schmutzig-ashgrau" under surface and large claws of *Mus dembeensis* do not agree by any means with *Desmomys*, but apply well to an

some Rarities from Abyssinia.

Skull: condylo-basal length 50; condylo-incisive length 51·2; zygomatic breadth 34·5; nasals $21 \times 6\cdot7$; interorbital breadth 7; mastoid breadth 25; diastema 20; palatilar length 27·5; bulla, antero-posterior diameter 11·8. Upper molar series, alveolar length 9·5, crowns 8·5.

The whole series is very closely uniform in size, the skull-dimensions of all adult specimens agreeing closely with the above.

Hab. as above; type from Dangila.

Type. Adult male. B.M. no. 28. 1. 11. 158. Original number 6087. Collected 25th June, 1926, by Major R. E. Cheesman. Thirty specimens.

The proper systematic treatment of the mole-rats of the genus *Tachyoryctes* is an exceedingly difficult matter, for they are very deficient in differential characters other than size, while in this they are so locally constant that the sizes cannot be ignored. In Abyssinia Rüppell obtained two species, the giant *macrocephalus* and the small *splendens*, while in E. Africa a number of forms allied to the latter have been described. The present animal, very uniform in size, while falling far short of *macrocephalus*, is constantly larger than *splendens*, of which we have about half-a-dozen specimens, including a Rüppell co-type (condylo-basal length 42 mm.). It would therefore seem necessary to give a special name to this intermediate form, and I am pleased to have the opportunity of naming it in honour of Major Cheesman, the maker and donor of the present fine collection.

I may note that there does not seem to be the sexual difference in colour observed in the Kilima-njaro species, *T. daemon*, in which the females were uniformly darker than the males, with a greater proportion of plumbeous individuals. But the two plumbeous individuals in Major Cheesman's collection are both females. Nor is there any material sexual difference in size of skull, although, of course, the males are more heavily ridged.

A specimen obtained by Dr. W. T. Blanford at L. Ashangi, about 135 miles E.N.E. of L. Tana, during the Abyssinian Expedition of 1867-8, also appears to belong to this species.

The following field-rat also appears to deserve description:—

Arvicanthis abyssinicus pelliceus, subsp. n.

Very like in general appearance—to the eye—to *A. abyssinicus zaphiri*, Dollm., the size and colour being quite

harsh as it is in nearly all the members of this common and widely distributed genus, is—to the touch—comparatively long and soft, almost as soft as in *Dasymys* or *Desmomys*. Wool-hairs of back about 15 mm. in length, the longer piles attaining 27, as compared with 11 and 18 in the type of *zaphiri*. Colour exactly as in *zaphiri*, except that there is a slight wash of buffy on the chest, and more ochraceous on the rump.

Skull about as in *zaphiri*, but the molar tooth-row longer and the teeth broader.

Dimensions of the type:—

Head and body 129 mm.; tail 129; hind foot 32; ear 20.

Skull: condylo-incisive length 33·6; zygomatic breadth 18; upper molar series (crowns) 7·3, (alveoli) 8.

Hab. Abyssinia, in region of Lake Tana. Type from Zauday Grar, south shore of the Lake. Alt. 5000'. A second specimen from Dungalbar, W. of the Lake.

Type. Adult female. B.M. No. 28.1.11.79. Original number 5468. Collected February 22, 1926, by Major R. E. Cheesman.

Soft fur is so remarkable a character in this group that I consider it best to give a special name to this rat, in spite of its resemblance to *A. a. zaphiri* in other respects.

No mention is made of the character of the fur in *Mus* (?) *rufidorsalis*, Heugl., but soft fur is so rare a character in the group that it cannot be assumed to occur in what its describer says is a common animal. Any determination of *rufidorsalis*, therefore, with no type in existence, would be mere guesswork, and it should probably be put down as a synonym of *A. abyssinicus*. Mr. Blick has been careful to give the hair-lengths in his three local subspecies of *A. abyssinicus*, and these are all practically as in *zaphiri*.

XXXV.—*Preliminary Description of Mymarothrips ritchianus, a new Type of Thysanopteron.* By RICHARD S. BAGNALL, F.R.S.E., F.L.S.

THE recent description of the West African genus *Corynothripoides* and its undoubted relationship with *Franklinothrips* led to the erection of the family Franklinothripidae for the reception of these genera, and incidentally to the raising of the then recognised divisions of the *Æolothripodea* to family rank—namely, the *Æolothripidae*, *Orothripidae*, and the

a new Type of Thysanopteron.

Melanothripidæ. The further African discovery now described, differing as it does in a most startling manner in the structure of its antennæ, palpi, and wings, makes it necessary for one to survey the complex with the utmost caution and criticism; for, it will be observed, only one cardinal character remains common and peculiar to all these divergent forms, namely, *the upturned ovipositor*. The 9-jointed antennæ (truly more or less different in details of structure and in their sensoria) are found also in other groups possessing the downturned ovipositor (as well as the mouth-parts and wings of the Thripodea), whilst the fore-tarsal hook is also found in conjunction with the 9-jointed antennæ in the families Heterothripidæ, Opadothripidæ, and Stenurothripidæ, Bagn., comprising the Heterothripodea.

In short, if these divergent forms are to be lumped together as in the past, the Heterothripodea with the fore-tarsus of the Æolothripodea, s. l., the antennæ of the Melanothripidæ, the mouth-parts of the Melanothripidæ and Thripodea, and the wings and ovipositor of the last-named group has an equal right of inclusion, but as this is clearly inadmissible then, equally, the forms now discussed cannot properly be so massed.

For these reasons I propose to revise and fully describe the Æolothripid complex at an early date, and, in the meantime, I find it necessary to erect a new superfamily for the insect now described, and also to remove the family Melanothripidæ from the Æolothripodea as at present defined.

These superfamilies may be diagnosed as follows:—

1. Antennæ with antennal joints 3 and 4 elongated and truly cylindrical; maxillary palpi geniculate, 3-jointed or 6-8-jointed, if 3-jointed joint 3 much smaller than 2; labial palpi 3-5-jointed (fore tibia, or antennal joints 1 or 2 never armed) [restricted.
ÆOLOTHRIPIDEA, as
2. Antennæ and palpi otherwise, the maxillary palpi not geniculate 2.
2. Antenna with intermediate joints stout, short, and heavy and each furnished with at least three whorls of forwardly directed bristles, joint 7 surmounted by a 2-jointed style. Maxillary palpi with a long basal joint and a series of seven closely connate minor joints, labial palpi 4-jointed. Wings narrow near base expanding broadly and roundly distally, the two longitudinal veins diverging considerably distally; lower margin of fore wing not truly ciliate. . MYMAROTHRIPIDEA, n.

3. Antenna normal, joints 3 and 4 not truly cylindrical and all joints movable (cf. Heterothripidae). Maxillary palpi 3-jointed, joint 3 not inferior to 2; labial palpi 2-jointed (cf. Heterothripidae, etc.). Wings broad, several times longer than broad, rounded at end and fore wings with several cross-veins; lower margins ciliate (cf. Heliothripidae and Orothripidae). *Apex of fore tibiae armed with a dagger-like scoop or, if simple, antennal joint 1 or 2 so armed* MELANOTHRIPIDAE, n. f.

Superfamily **MYMAROTHRIPIDAE**, nov.

Family **Mymarothripidae**, nov.

Ovipositor up-turned; antenna 9-jointed; fore-tarsal hook present. Head transverse; maxillary palpi 8-jointed but not geniculate, with a long basal joint and a series of seven short segments; labial palpi 4-jointed. Antennal joints 3 to 6 short, broad, and heavy, rounded at base but truncate distally, and each having a short central produced piece for the juncture with succeeding joint; 7 with the apex truncate surmounted by a 2-jointed style; sensoria on 3-5 (? 6) in the form of transverse wavy tympanous area on a line with the circumference at apex; joints 3-7 furnished with three or four whorls of long forwardly-directed bristles, the lowest approaching the basal margin. Wings narrow basally and then widening roundly to about 2.5 their basal width, and broadly rounded at apex, lower margins not truly ciliate; fore wing with two longitudinal veins which diverge strongly distally to join the anterior and posterior margins of the wing near its greatest breadth; upper vein with a not easily distinguishable cross-vein connecting it with the costa near the distal third; margin throughout furnished with two series of more or less fine setae, those on the lower margin less strong and with the secondary series short and very fine.

Genus *Mymarothrips*, nov.

With the characters of the family.

Type. *Mymarothrips ritchianus*, sp. n.

Mymarothrips ritchianus, sp. n.

♀. Length about 1.35 mm.

Colour pale yellow more or less lightly tinged with grey;

* Including the genera *Melanothrips*, Hal., *Cranothrips*, Bagn., *Eocranothrips*, Bagn. (fossil), *Ankothrips*, Crawf., and *Archankothrips*, Pr. (fossil). The genus *Opadothrips*, Pr. (fossil), has had to be removed

a new Type of Thysanopteron.

antennæ dark brown to blackish brown, joints 1 and 2 and 7-9 not quite so dark as the intermediate joints; eyes black; cheeks brown; sides of pronotum pale grey-brown. Abdominal segment 9 distally and 10 wholly brown. Basal half or thereabouts of fore wing clear, apparently very lightly tinged basally, then a pale greyish-brown band somewhat darker at its commencement and distinctly darker distally where it coincides with the juncture of the upper- and ring-vein, the latter of which is darker also and continues so for about two-thirds of the rounded end; lower wing pale except for the margin near end corresponding to the darker margin of the fore wing.

Head transverse; antenna heavy, about three times as long as the head, with the relative length and breadth of the joints approximately as follows:—

$$32.5 (38) : 52 (34) : 85 (38) : 58 (c. 41) : 57 (41) : \\ 54 (41) : 56 (33) : 15 (12 \text{ to } 7) : 14 (6) \mu.$$

The left antenna has the joints 6-9 missing, whilst 3-5 are turned sideways, in which aspect they are only about 0.5 as broad as dorso-ventrally (though the dorso-ventral aspect suggests a cylindrical joint), slightly wider basally than medianly, and widening at extreme apex. Maxillary palpi with joints 2-8 together about 1.25 times as long as 1 ($34:42 \mu$); labial palpi short (22μ), 4-jointed, with 1 the longest and 2 the shortest*.

Pronotum rectangular, as long as the head and about 1.6 times as broad as long, furnished with several fine and longish setæ disposed irregularly in two rows along the anterior and lateral margins and ranging from $30-60 \mu$ in length. A single subpostero-angular is the longest of all, being about 100μ , whilst a median postero-marginal pair measuring c. 60μ and separated by c. 70μ is duplicated by a slightly smaller pair on an immediately higher plane, these latter being on the same plane as the sub-postero-angulars.

Legs slender. Fore wings furnished with 24-25 setæ on upper vein and c. 18 on the lower.

Type. In the British Museum of Natural History.

Hab. E. Africa, Tanganyika Territory, Rubunge. 1 ♀ on *Coffea arabica*, 21.ix.1926 (A. H. Ritchie, No. 526) I.B.E.Lg. 4166.

I have much pleasure in dedicating this important and intensely interesting species to its discoverer.

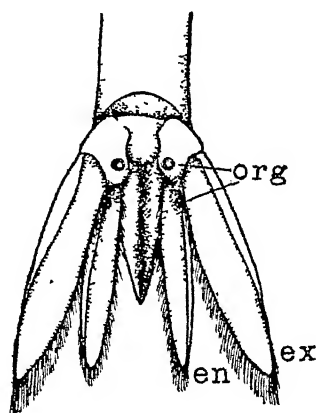
* Possibly 5-jointed with a scarcely distinguishable basal joint.

XXXVI.—*Note on the Tail-organs of Acetes.*
By Yô K. OKADA, Naba, Hyogo-kén (Japan).

(From the Marine Biological Laboratory, Plymouth.)

IN certain Malacostraca more or less specialized organs are found in connection with the function of balance. In most Decapoda there is an invagination of the integument in the basal segment of the antennule having sensory setæ on its inner surface. In some cases the sac remains open to the exterior, permitting the introduction of sand-grains, which are supposed to act as "statolithes." In other cases the sac is completely closed, and may then contain a statolith secreted by its wall-cells. Statocysts are found in a few other Malacostraca in various positions, the most widely spread positions

Fig. 1.



Tail of *Acetes japonicus*, showing the organs (*org*) in the uropods.

of them being, however, in the tail—for example, in the endopodites of the uropods of the Mysidæ and in the telson of certain genera (*Authura*, *Cyathura*) of the Authuridæ (Isopoda)*.

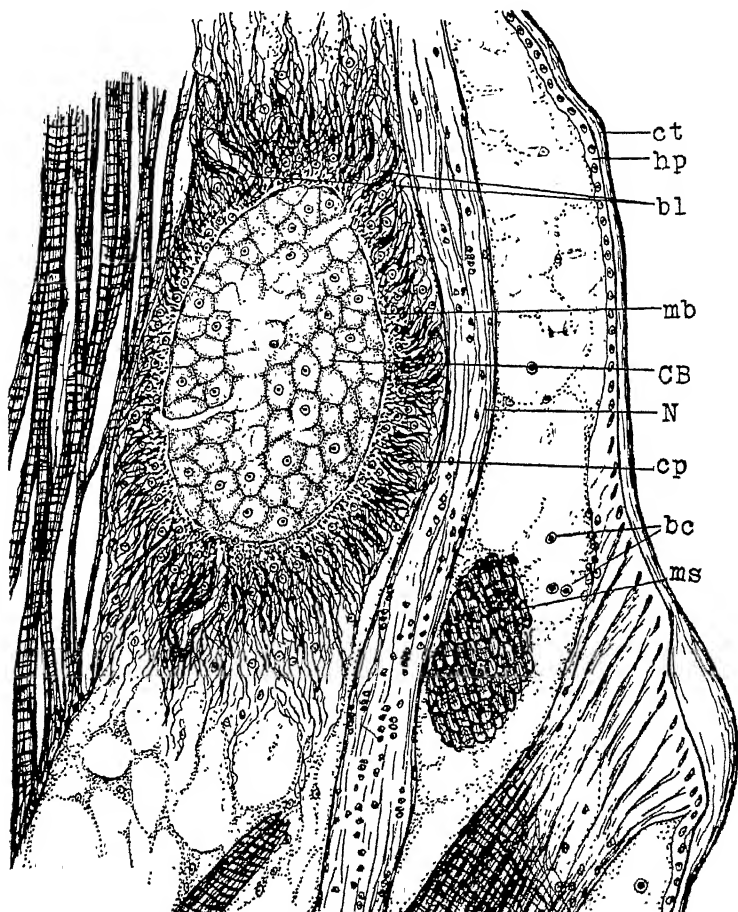
I have already discovered two pairs of certain organs in the tail of *Acetes japonica*, Kishinouyé. Notwithstanding their systematic position being low among Decapoda, some genera (*Lucifer*, *Sergestes*) of the Sergestidæ, to which belongs the shrimp in question, have been described to possess closed

* Thienemann, A., 1903, Zool. Anz. Bd. xxvi. p. 406; Sexton, E. W., 1914, Journ. Mar. Biol. Assoc. vol. x. p. 236.

the Tail-organs of Acetes.

statocysts in the antennules. I am not sure whether the antennules of *Acetes* are provided with such statocysts or not, but probably they are. Does *Acetes*, then, possess two types

Fig. 2.



Longitudinal section of the basal joint of an uropod, $\times 350$.

bl, capillaries; *bc*, blood-corpuscles; *CB*, central body of an anterior tail-organ; *cp*, outer capsule of radial fibres; *ct*, outer cuticle; *hp*, hypoderm; *mb*, inner capsule of circular fibres; *ms*, muscle-bundle; *N*, nerve.

of organs of balance in so different positions as the head and the tail? To know something about the tail-organs I have examined their structure in sections.

On the Tail-organs of Acetes.

The organs are visible in the fresh condition as red spots placed on each side, one in the basal segment of the uropod and the other in its endopodit (fig. 1). This latter is found in almost the same situation as the externally similar organ (but true statocyst) of the Mysidæ. But the anterior spot, which is larger than the posterior, has no corresponding organ in any other Crustacea.

The structure of the tail-organs was found to be the same in all four—anterior and posterior, or right and left. One of the anterior spots is shown in fig. 2. As will be readily seen from the figure, the organ is found in the loose mesenchymatous tissue of the uropod closely applied externally to the nerve and internally to a bundle of the muscles, and, contrary to all expectations, is not vesicular, as are true statocysts. A mass of large plump cells having round nuclei form its centre. This cellular mass is limited by a thin layer of circular fibres, and externally is clothed by a thick investment of radial fibres which in the fresh state are heavily loaded with red pigment granules, the pigment dissolving quickly in alcohol. The investment is pierced here and there by a number of what are possibly blood-capillaries (I could find no corpuscles in them). Prof. H. Coutière, who has examined my sections, suggests that the organs may be photogenic. This interpretation seems quite possible from the standpoint of the structure at least. Moreover, we know in the Sergestidæ a genus (*Sergestes*) which produces a luminescent light. But we have no information of light-production in *Acetes*, and the organs above described are very different from the structure of the *Sergestes* photophores*. I am not, of course, of the opinion that the tail-organs are statocysts or any organs of similar function, but still hesitate to assign a photogenic property to them simply because their structure resembles that of known light-producing organs. I wait for actual observations in the living animal. These tail-organs of *Acetes* seem to have been considered to be merely chromatic patterns, it not having been known that they exhibit a special structure†. Hence the reason for this small note.

* Hansen, H. J., 1903, Proc. Zool. Soc. Lond. p. 72; Kemp, S., 1910, Proc. Zool. Soc. Lond. p. 639; Terao, A., 1917, Ann. Zool. Jap. vol. ix. p. 299.

† Kishinouyé, K., 1903, Ann. Zool. Jap. vol. v. p. 166.

XXXVII.—*Notes on some unnamed Polynoids in the British Museum.* By C. C. A. MONRO.

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DURING my examination of a large number of Polychæta collected by Dr. C. Crossland and Dr. Th. Mortensen in the vicinity of the Panama Canal, I had occasion to determine a number of unnamed specimens from various sources other than the Panama collections.

The following notes were made on some Polynoids which in this manner came to be examined.

Family Polynoidæ.

Halosydna insignis, Baird.

Halosydna insignis, Baird, 1863, p. 106.

Occurrence. Friday Harbour, Vancouver Island (*Coll. F. A. Potts*).

Remarks. Two specimens, of which the largest measures 20 mm. by 16 mm. including the feet.

This species may be a variety of *H. brevisetosa*, as Johnson suggests. There are, however, some points of difference, which incline me to keep the two species separate and to await the evidence of further material. In the examples before me, the body-colour of *H. brevisetosa* is yellow and that of *H. insignis* a bluish grey. *H. insignis* is more elongate and vermiform, more quadrangular in section than *H. brevisetosa*, and the elytra overlap in the mid-dorsal line. Also in *H. insignis* the tentacles and cirri are markedly more slender and tapering than those in *H. brevisetosa*, and there is no subterminal enlargement. Furthermore, in *H. insignis* the elytra are almost wholly smooth after the first three pairs. In *H. brevisetosa* they retain a few small tubercles. There appear to be no appreciable differences in the feet.

Halosydna brevisetosa, Kinberg.

Halosydna brevisetosa, Kinberg, 1857, p. 18, pl. v. fig. 25; Johnson, 1897, pp. 167-170, pl. vi. fig. 24, pl. vii. figs. 30, 40, 40a, pl. viii. figs. 46, 46a; Seidler, 1924, p. 125.

Occurrence. Queen Charlotte Island, British Columbia.

Remarks. One specimen, 35 mm. by 12 mm. including the feet. Johnson gives a full description and good figures of this species, and Seidler an extensive synonymy. It appears to be characterised by the heavy squarish shape of the

tentaculophores and by the reduction of the tuberculation of the elytra after the first three or four pairs.

This specimen is atypical in that the tuberculation of the elytra, though much reduced after the first three or four segments, continues to the end of the body. Baird's *Lepidonotus* (*Halosydna*) *grubei* is undoubtedly the same as this species. Its relation to *Halosydna insignis* is discussed under the heading of that species.

Halosydnooides vittata (Grube).

Polynoe lordi, Johnson, 1897, p. 175, pl. vii. figs. 35, 44, pl. viii. figs. 51, 51 a, 51 b.

Halosydnooides vittata, Seidler, 1924, p. 134.

Occurrence. Queen Charlotte Island, British Columbia.

Remarks. One specimen, measuring 25 mm. by 7 mm. including the feet. The bifurcate dorsal and the curved ventral chaetæ of this species are quite characteristic. Seidler regards it as a transitional form between *Halosydna* and *Lepidasthenia*. It is well figured by Johnson. This specimen has many more dorsal chaetæ than I have observed in other examples of the species.

Lepidonotus cristatus (Grube).

Lepidonotus cristatus, Gravier, 1901, pp. 210-214.

Occurrence. Murray Island, Vancouver (Coll. F. A. Potts), King's Sound, West Australia.

One large specimen, from Murray Island, measuring 43 mm. by 12 mm. including the feet, and two small from King's Sound, the largest of which measures 24 mm. by 12 mm. including the feet. The Murray Island specimen is very striking; all the tentacles and cirri are deep black, as are the very large sacs on the elytra. These are perfectly smooth to the naked eye, but under the microscope are thickly covered with the usual small papillæ.

Seidler regards this species as being synonymous with *L. oculatus*, Baird. I have examined Baird's type, and the elytra show no trace of the sacs or crests characteristic of this species.

Fauvel's redescription of *L. oculatus* is accurate, the minute structure of the elytra being very characteristic. *L. cristatus* has been fully redescribed by Gravier, and varieties noted by Potts and Horst.

In my specimens from W. Australia all the colour has disappeared from the elytra.

Lepidonotus cristatus, var. *ornata*, Potts.

Lepidonotus cristatus, Potts, 1910, p. 333, pl. xviii. figs. 6, 7.

Occurrence. Macclesfield Bank, China Sea, 45 fathoms (*H.M.S. 'Egeria'*).

Remarks. One specimen, measuring 17 mm. by 7 mm. including the feet.

This species is easily distinguishable by the remarkable chitinous growths on the elytra, together with the highly developed peaked nuchal collar.

My specimen differs from Potts's in having a slight spur or notch beneath the apex of the ventral chætæ. The tuberculation of the elytra seems to be intermediate between that of Potts's var. *echinata* and his var. *ornata*. The large chitinous processes resemble those of var. *ornata*, but there are also a number of hooked spines such as Potts figures for var. *echinata*.

Lepidonotus oculatus, Baird.

Lepidonotus oculatus, Fauvel, 1917, pp. 171-173.

Occurrence. Port Phillip Heads, South Australia (*J. B. Wilson*).

One specimen, measuring 46 mm. by 15 mm. including the feet. Fauvel (1917, pp. 171-173) has given a full account of this species, to which I have little to add. It is characterised by the mushroom-shaped papillæ on the elytra. All the colour is gone from my specimen.

Fig. 1.



Lepidonotus oculatus, Baird. Dorsal chætæ. $\times 270$.

Fauvel's figure (text-fig. 4 b) of the dorsal chætæ fails to show the fine striations.

My specimen is very much damaged, so the figure (fig. 1) of this bristle is drawn from the type-specimen.

Malmgrenia boholensis (Grube).

Polynoe boholensis, Grube, 1878, p. 41, pl. i. fig. 7.

Parulepidonotus boholensis, Horst, 1917, p. 77, pl. xviii. figs. 1-2.

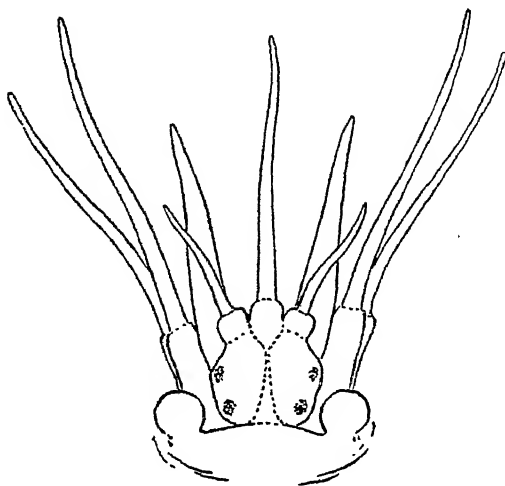
Harmothoe boholensis, Fauvel, 1919, pp. 332-334.

Malmgrenia boholensis, Augener, 1927, pp. 128-129.

Occurrence. King's Sound, West Australia.

Remarks. One specimen, measuring 31 mm. by 12 mm. including the feet. The colouring has completely disappeared. I have followed Augener, as being the latest

Fig. 2.



Malmgrenia boholensis (Grube). Head. $\times 12$.

to take up the difficult question of the correct generic attribution of this species. There is no necessity to reopen the discussion. I give a figure of the head (fig. 2), which appears to be decidedly unharmothoid in character.

Parahalosydna chinensis, sp. n.

Occurrence. Amoy, China (Coll. C. Ping).

Description. Two specimens, self-coloured, the larger one measuring 21 mm. by 6 mm. including the feet. The prostomium is of the lepidonotid type. The anterior and larger pair of eyes is situated at the sides of the prostomium about halfway down its length. The posterior pair is just in front of the nuchal fold, which rises up into two contiguous peaks in the median line. The median tentacle, which unfortunately became detached during the examination, is longer than the other appendages. The lateral tentacles are terminally inserted and, like the cirri, are banded with black at their bases and just below the terminal enlargement. The palps are coloured dark throughout their

together with these families and with the family Necrophasmidæ, to the same suborder.

How are we to name this suborder? Although the designation *Aeroplanoptera*, Till., was proposed earlier (1918), it would hardly be suitable, because it concerns one family only, and this family (*Aeroplanidæ*) was attributed to another order (*Protodonata*, then a separate order). The name *Necrophasmatodea*, Mart., also concerns a single family, and was proposed later. I suggest it will be more correct to name this suborder *Chresmododea* on grounds of the genus *Chresmoda*, which was known long ago. This suborder contains therefore four families, and may be characterised as follows :—

Suborder CHRESMODODEA, NOV.

Anterior wings well developed, long and rather narrow, with longitudinal veins usually parallel, connected by rows of cross-veins; net lacking. Costal region usually rather broad in its basal portion, gradually narrowing to the end of *SC*; *R* strong; *SC* running close to it; *RS* simple, rarely with a few branches in its end portion. *M* divides near the base into two main branches, which may furcate again. *Cu* simple and long, rarely bearing a few branches in its distal portion; anals also stretched, straight.

The neururation of the costo-cubital portion in the posterior wings closely resembles that in the anterior ones, but the ano-jugal region is strongly developed, forming a fan. The general outline of the body and that of the appendages is known only in the family *Chresmodidæ*. In this family the head is rounded, with short many-jointed antennæ; pronotum more broad than long; legs very long. Abdomen not stretched, with normal segments, which are more broad than long. Cerci apparently present. Size not very large.

Upper Trias of Australia, Jura of Europe, and Turkestan.
This suborder now contains four families :—

1. Family *Chresmodidæ*, Handlirsch*, with one gen (*Chresmoda*) and two species. Upper Jura Bavaria and of England.
2. Family *Necrophasmidæ*, Martynov, with one gen and one species. Upper Lias of Turkestan (Galkino).

* *Chresmodidæ* (Haase), Handlirsch, Foss. Insekten, S. 523; Schröder Handb. d. Entomol., Lief. 5, 1921, S. 189.

3. Family Aeroplanidæ, Tillyard, with one genus and one species. Upper Trias of Australia.
4. Family Aerophasmidæ, Martynov, with one genus and one species. Upper Lias of Turkestan (Galkino).

There still exists one Mesozoic form, in all probability belonging to the order Phasmatodea (*Raphidium brephos*, Westwood *), from the Upper Jura of England. This form is known by an anterior wing only—"Ein kleiner, etwa 9 mm. langer Flügel mit eigentümlich netzartigen Geäder, welches auffallend an jenes rezenter Phasmiden-Vorderflügel erinnert." This short definition * of Handlirsch is quite true. Judging by Handlirsch's fig. 21, pl. xlv., the neuration of the fore wing in *Raphidium brephos* really resembles much more that in recent Phasmids than that in the suborder Chresmododea—therefore this order cannot be attributed to the just-mentioned suborder.

*Table for determining the Families in the Suborder
Chresmododea (on the anterior wings).*

- 1 (4). *R* and *M*, or *R* alone, divides rather far from the base of the wing, in the 2nd fourth, or near the middle of the wing; wings (anterior) narrowing to their ends.
- 2 (3). *RS* separates from *R* in the distal part of the 2nd fourth of the wing; *M* divides near the base of the wing into two long simple branches; analia not very long, *A*₁ terminates near the middle of the wing *Necrophusmidæ*, Mart.
- 3 (2). *M* divides farther from the base, not far from the origin of *RS*; *Cu* and analia long and parallel *Chresmodidæ*, Handl.
 - 1). *RS* separates from *R* at the end of the 1st fourth or at the base of the 2nd fourth of the wing; *M* divides in the basal fourth of the wing and forms four or more branches; distal half of wing (anterior) does not narrow to its end.
 - 1). *RS* forms three branches in its distal portion; *MA* and *MP* divide, each, once *Aerophasmidæ*, Mart.
 - 1). *RS* simple; *M* forms more than four branches *Aeroplanidæ*, Till.

* *Raphidium brephos*, Westwood, Quart. Journ. Geol. Sci. x. p. 395, xvii. fig. 16 (1854); Handlirsch, Foss. Insekten, p. 598, pl. xlv. fig. 21.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[TENTH SERIES.]

No. 3. MARCH 1928.

XLI.—*Records of some Parasitic Worms from British Vertebrates.* By H. A. BAYLIS, M.A., D.Sc., Department of Zoology, British Museum (Natural History).

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COMPARATIVELY little work appears to have been done for many years on the helminthological fauna of the British Isles, with the exception of the parasites of domestic animals. The majority of the British wild vertebrates belong to species which occur also on the continent of Europe, and it is, of course, highly probable that they harbour for the most part the same parasites wherever they are found. But, except for definitely migratory species, this cannot be assumed without proof, and hitherto few attempts appear to have been made to explore this field of inquiry.

As regards one group—the Trematodes—a series of useful lists of forms that may occur in British vertebrates of different groups has been published during the last few years by Nicoll*. But, with the exception of the earliest, which deals with the Trematodes of marine fishes, these lists appear to be based almost entirely on continental records, and should not be taken as indicating that the species mentioned have actually been recorded in this country.

* 'Parasitology,' vii. pp. 339-378 (1915); xv. pp. 151-202, 236-252 (1923); xvi. pp. 127-144, 329-331 (1924); xviii. pp. 14-20 (1926).

Almost the only recent publications specially devoted to British records are a list of parasites collected at St. Andrews, Fife-shire, over a number of years, published by Professor W. C. McIntosh*, and two papers by E. A. Lewis† recording some of the parasites occurring in wild vertebrates in the Aberystwyth district of Wales.

It is thought, therefore, that a list of parasites actually obtained from vertebrates within these islands, or off their coasts, however partial and imperfect, may not be without some interest. These records represent species that have come under the personal notice of the writer in the course of routine work during several years. Time and opportunity have not been available for systematic or thorough collecting, and no attempt of this nature has been made. The records refer simply to specimens received for identification from correspondents too numerous to mention by name, or to material personally collected by the writer as opportunities occurred from time to time. In connection with the latter category special mention must be made of the enthusiastic help rendered by Mr. A. H. Bishop, the able taxidermist of the Department, who has handed over to the writer the bodies of many birds, including several comparatively rare species.

In the following list the hosts are mentioned under the parasites found in them, together with the approximate locality and date of collection, wherever these have been noted. The determination of the parasites is, in practically all cases, the writer's. Where any element of doubt remains as to the identity of a species, this is indicated by a query. For the most part only mature forms, whose specific determination could be made with reasonable certainty, have been included in the list. Parasites from domesticated or imported animals, or animals that had lived in captivity or under artificial conditions of any kind, are excluded.

TREMATODES.

Azygia lucii (Müller, 1776).

Pike (*Esox lucius*), Norfolk, December.

Brachycoelium salamandræ (Fülich, 1789).

Slow-worm (*Anguis fragilis*), Devon, July.

Campylu oblonga (Cobbold, 1858), Braun, 1900.

Porpoise (*Phocæna phocæna*), August.

* Ann. & Mag. Nat. Hist. (9) xix. pp. 49-94 (1927).

† Journ. Helminthol. iv. pp. 7-12 (1926), and v. pp. 121-132 (1927).

Catantropis verrucosa (Frölich, 1789).

Moorhen (*Gallinula chloropus*), Argyllshire; Shelduck (*Tadorna tadorna*), Outer Hebrides, September.

Crepidostomum farionis (Müller, 1784).

Trout (*Salmo trutta*).

Diplodiscus subclavatus (Goeze, 1782).

Frog (*Rana temporaria*).

Diplostomum [= *Tetracotyle*] *cuticola*, Nordmann, 1832.

Roach (*Rutilus rutilus*), R. Trent, March.

Distoma exasperatum, Rud., 1819 (= *rubens*, Duj.).

Common shrew (*Sorex araneus*), near Oxford.

Distoma migrans, Duj., 1845.

Common shrew (*Sorex araneus*), near Oxford.

Echinoparyphium baculus (Diesing, 1850).

Scaup-duck (*Nyroca marila*), Kirkcudbrightshire, October.

Echinoparyphium recurvatum (v. Linstow, 1873).

Pintail (*Dafila acuta*), Kent, November.

Echinostoma ? *paraulum*, Dietz, 1909.

Mallard (*Anas boschas*), Hertfordshire.

Echinostoma pungens, v. Linstow, 1894.

Little grebe (*Podiceps fluviatilis*), Kent, January.

Echinostoma revolutum (Frölich, 1802).

Mute swan (*Cygnus olor*), Cambridgeshire, October.

Gyrodactylus medius, Kathariner, 1894.

Minnow (*Phoxinus phoxinus*), near Edinburgh.

Haplometra cylindracea (Zeder, 1800).

Frog (*Rana temporaria*), Somerset.

Harmostomum fuscatum (Rudolphi, 1819).

Starling (*Sturnus vulgaris*), Devon, January.

Harmostomum recurvum (Dujardin, 1845).

Wood-mouse (*Apodemus sylvaticus*), near Oxford.

Hemistomum excavatum (Rudolphi, 1803).

Bittern (*Botaurus stellaris*), Sussex, December.

Hemistomum spathaceum (Rudolphi, 1819).

Black-headed gull (*Larus ridibundus*), Surrey, January.

Himasthla leptosoma (Creplin, 1829).

Knot (*Tringa canutus*).

Hypoderæum conoideum (Bloch, 1782).

Teal (*Nettion crecca*), Norfolk, October; Mallard (*Anas boschas*), Hertfordshire; Outer Hebrides, September.

Lecithochirium gravidum, Looss, 1907.

Conger (*Conger conger*), Guernsey, July.

Lecithochirium rufoviride (Rudolphi, 1819).

Conger (*Conger conger*), Guernsey, July.

Lepoderma ? muris, Tanabe, 1922.

Wood-mouse (*Apodemus sylvaticus*), near Oxford.

Leucochloridium macrostomum (Rudolphi, 1803).

Water-rail (*Rallus aquaticus*), Middlesex, November.

Lerinseniella propinqua, Jägerskiöld, 1907.

Redshank (*Totanus totanus*), Firth of Clyde.

Lyperosomum vitta (Dujardin, 1845).

Wood-mouse (*Apodemus sylvaticus*), near Oxford.

Notocotylus attenuatus (Rudolphi, 1809).

Mallard (*Anas boschas*), Hertfordshire.

Notocotylus noyeri, Joyeux, 1922.

Water-vole (*Arvicola amphibius*), Cambridgeshire, November.

Octobothrium (Discocotyle) sagittatum, Leuckart, 1842.

Trout (*Salmo trutta*), Jersey.

Octobothrium (Octocotyle) scomberi (Kuhn, 1829).

Mackerel (*Scomber scomber*), Guernsey, July.

Opisthioglyphe rastellus (Olsson, 1876).

Frog (*Rana temporaria*).

Orchidasma amphiorchis (Braun, 1899).

Loggerhead turtle (*Thalassochelys caretta*), Lancashire.

Platynosomum ? petiolatum (Railliet, 1900).

Blackbird (*Turdus merula*).

Pleurogenes clariger (Rudolphi, 1819).

Frog (*Rana temporaria*).

Polystomum integerrimum (Frölich, 1791).

Frog (*Rana temporaria*).

Strigea gracilis (Rudolphi, 1819).

Teal (*Nettion crecca*), Norfolk, January and October.

Strigea ? tarda (Steenstrup, 1842).

Mute swan (*Cygnus olor*), Cambridgeshire, October.

Telorchis ercolanii (Monticelli, 1893).

Grass-snake (*Natrix natrix*), Cambridgeshire.

Tetracotyle phoxini, Faust, 1918.

Minnow (*Phoxinus phoxinus*), near Edinburgh.

Tristoma molæ (Rudolphi, 1819).

Sunfish (*Mola mola*), Ireland.

CESTODES.

Amœbotænia subterranea, Cholodkovsky, 1906.

Common shrew (*Sorex araneus*), near Oxford.

Anomotænia constricta (Molin, 1858).

Rook (*Corvus frugilegus*), Hertfordshire ; Carrion-crow (*Corvus corone*) ; Song-thrush (*Turdus musicus*).

Anomotænia pyriformis (Wedl, 1855) (?).

Water-rail (*Rallus aquaticus*), Middlesex, November.

Aploparaksis dujardinii (Krabbe, 1869).

Song-thrush (*Turdus musicus*), Scotland ; Blackbird (*Turdus merula*) ; (?) Starling (*Sturnus vulgaris*), Devon, January.

Biuterina lobata, Fuhrmann, 1908.

Hoopoe (*Upupa epops*), Yorkshire.

Bothriocephalus ? bipunctatus (Zeder, 1800).

Father-lasher (*Cottus scorpius*), S. Devon.

Bothriocephalus claviceps (Goeze, 1782).

Eel (*Anguilla anguilla*), Worcestershire.

Catenotænia lobata, Baer, 1925.

Wood-mouse (*Apodemus sylvaticus*), near Oxford.

Catenotænia pusilla (Goeze, 1782).

Bank-vole (*Exotomys glareolus*), near Oxford; House-mouse (*Mus musculus*), Surrey, January.

Choanotænia ? borealis (v. Linstow, 1905).

Mallard (*Anas boschas*), Hertfordshire; Shelduck (*Tadorna tadorna*), Outer Hebrides, September.

Choanotænia infundibulum (Bloch, 1779).

Partridge (*Perdix perdix*); Red-legged partridge (*Caccabis rufa*), Suffolk, October.

Choanotænia producta (Krabbe, 1869) (?).

Green woodpecker (*Gecinus viridis*).

Cænomorphus grossus (Rudolphi, 1819).

Salmon (*Salmo salar*), Aberdeenshire.

Davainea ? brevicollis (Frölich, 1802).

Cuckoo (*Cuculus canorus*), Perthshire, May.

Dilepis ? brachyarthra, Cholodkovsky, 1906.

Carion-crow (*Corvus corone*), Middlesex, March.

Dilepis undula (Schrank, 1788).

Blackbird (*Turdus merula*), Hertfordshire and elsewhere; Song-thrush (*Turdus musicus*); Missel-thrush (*Turdus viscivorus*), Hertfordshire, January; Jackdaw (*Corvus monedula*), Hertfordshire; Starling (*Sturnus vulgaris*), Devon, January.

Fimbriaria fasciolaris (Pallas, 1781).

Mallard (*Anas boschas*), Hertfordshire; Scaup-duck (*Nyroca marila*), Outer Hebrides, October.

Hymenolepis arcuata, Kowalevsky, 1904.

Scaup-duck (*Nyroca marila*), Outer Hebrides, October.

Hymenolepis collaris (Batsch, 1786) (?).

Mallard (*Anas boschas*), Hertfordshire.

Hymenolepis compressa (Linton, 1892).

Scaup-duck (*Nyroca marila*), Outer Hebrides, October; Kirkeudbrightshire, October.

Hymenolepis diaphana, Cholodkovsky, 1906.

Common shrew (*Sorex araneus*), near Oxford.

Hymenolepis diminuta (Rudolphi, 1819).

Brown rat (*Rattus norvegicus*), London.

Hymenolepis macracanthos (v. Linstow, 1877).

Scaup-duck (*Nyroca marila*), Outer Hebrides, October.

Hymenolepis microps (Diesing, 1850).

Red grouse (*Lagopus scoticus*), Scotland.

Hymenolepis ? *microstoma*, Dujardin, 1845.

Field-vole (*Microtus agrestis*), near Oxford.

Hymenolepis naja (Dujardin, 1845).

Nuthatch (*Sitta cæsia*), Sussex, November.

Hymenolepis nana (v. Siebold, 1852).

Brown rat (*Rattus norvegicus*), London; Black rat (*Rattus rattus*), Berkshire.

Hymenolepis ? *parina*, Fuhrmann, 1907.

Coal-tit (*Parus ater*), Sussex.

Hymenolepis parvula, Kowalevsky, 1904.

Mallard (*Anas boschas*), Hertfordshire.

Hymenolepis ? *phasianina*, Fuhrmann, 1907.

Pheasant (*Phasianus colchicus*).

Hymenolepis ? *pistillum* (Dujardin, 1845).

Common shrew (*Sorex araneus*), near Oxford.

Hymenolepis ? *scalaris* (Dujardin, 1845).

Common shrew (*Sorex araneus*), near Oxford.

Hymenolepis scutigera (Dujardin, 1845).

Common shrew (*Sorex araneus*), near Oxford.

Hymenolepis ? *serpentulus* (Schrank, 1788).

Song-thrush (*Turdus musicus*), Scotland; Jackdaw (*Corvus monedula*), Hertfordshire.

Hymenolepis singularis, Cholodkovsky, 1912.

Common shrew (*Sorex araneus*), near Oxford.

Hymenolepis ? *trifolium*, v. Linstow, 1905.

Mallard (*Anas boschas*), Hertfordshire.

Hymenolepis ? *uncinata* (Stieda, 1862).

Common shrew (*Sorex araneus*), near Oxford.

Ligula intestinalis (Goeze, 1782).

Adult : Great crested grebe (*Podiceps cristatus*).

Larva : Roach (*Rutilus rutilus*), Worcestershire, April ; Norfolk, January ; Staffordshire ; Essex.

Nematotænia dispar (Goeze, 1782).

Toad (*Bufo vulgaris*), Hertfordshire ; Frog (*Rana temporaria*) ; Frog (*Rana* sp.), Guernsey.

Onchobothrium uncinatum (Rudolphi, 1819).

Smooth hound (*Mustelus lævis*), S. Devon.

Onchobothrium verticillatum (Rudolphi, 1819).

Smooth hound (*Mustelus lævis*), S. Devon.

Orygmatobothrium musteli (v. Beneden, 1850).

Smooth hound (*Mustelus lævis*), S. Devon.

Parachoanotænia gongyla (Cohn, 1900) (?).

Lesser black-backed gull (*Larus fuscus*), Cambridgeshire, October.

Paranoplocephala blanchardi (Moniez, 1891) (?).

Bank-vole (*Evotomys glareolus*), near Oxford ; Field-vole (*Microtus agrestis*), near Oxford.

Raillietina urogalli (Modeer, 1790).

Red grouse (*Lagopus scoticus*), Scotland.

Schistocephalus gasterostei (Fabricius, 1780).

Adult : Red-throated diver (*Colymbus stellatus* [= *septentrionalis*]), Kent, January.

Larva : Ten-spined stickleback (*Gasterosteus pungitius*), Yorkshire ; Three-spined stickleback (*Gasterosteus aculeatus*), Essex ; Middlesex.

Tænia pisiformis (Bloch, 1780).

Larva : Rabbit (*Oryctolagus cuniculus*).

Tænia tæniæformis (Batsch, 1786).

Adult : Wild cat (*Felis sylvestris*), Perthshire, December.

Larva : Wood-mouse (*Apodemus sylvaticus*), near Oxford ; House-mouse (*Mus musculus*), St. Kilda.

Tænia tenuicollis (Rudolphi, 1819).

Larva (= *Cysticercus innominatus hypudæi*, Leuckart) : Bank-vole (*Evotomys glareolus*), near Oxford ; Field-vole (*Microtus agrestis*), near Oxford.

Tetrabothrius ? *cylindraceus* (Rudolphi, 1819).

Fulmar petrel (*Fulmarus glacialis*), North Sea, January.

Tetrabothrius macrocephalus (Rudolphi, 1810).

Red-throated diver (*Colymbus stellatus* [= *septentrionalis*]), Kent, January.

Tetrarhynchus longicollis (v. Beneden, 1849).

Smooth hound (*Mustelus levis*), S. Devon.

Triclenophorus nodulosus (Pallas, 1781).

Pike (*Esox lucius*), Wiltshire; Hertfordshire.

NEMATODES.

Acuaria (*Synhimantus*) sp.

Hobby (*Falco subbuteo*), Hampshire.

Amidostomum ? *monodon* (v. Linstow, 1882).

Common scoter (*Oidemia nigra*), Norfolk, November.

Aplectana acuminata (Schrank, 1788).

Toad (*Bufo vulgaris*), Middlesex; Frog (*Rana temporaria*), Cambridgeshire, &c.

Aspieuluris tetraptera (Nitzsch, 1821).

Bank-vole (*Evotomys glareolus*), near Oxford.

Capillaria contorta (Creplin, 1839).

Carrion-crow (*Corvus corone*), Middlesex, March.

Capillaria ? *exilis* (Dujardin, 1845).

Blackbird (*Turdus merula*), Hertfordshire; Starling (*Sturnus vulgaris*), Devon, January.

Capillaria filiformis (v. Linstow, 1885).

Crested newt (*Molge cristata*), Cambridgeshire, April and September.

Capillaria incrassata, Diesing, 1851 [= *Liniscus exilis*, Dujardin, 1845].

Common shrew (*Sorex araneus*), near Oxford.

Capillaria longevaginata (v. Linstow, 1879).

Sky-lark (*Alauda arvensis*), Sussex, March.

Capillaria longicollis (Rudolphi, 1819).

Pheasant (*Phasianus colchicus*).

Capillaria ? muris-sylvatici (Diesing, 1851).

Wood-mouse (*Apodemus sylvaticus*), near Oxford ; Bank-vole (*Eutamias glareolus*), near Oxford.

Capillaria ovopunctata (v. Linstow, 1873).

Starling (*Sturnus vulgaris*), Pembrokeshire, February ; Devon, January.

Capillaria resecta (Dujardin, 1843).

Jackdaw (*Corvus monedula*), Staffordshire, March ; Hertfordshire ; Rook (*Corvus frugilegus*), Hertfordshire.

Capillaria ? tenuissima (Rudolphi, 1803).

Little owl (*Athene noctua*), Surrey, January.

Contracæcum aduncum (Rudolphi, 1802).

Allis shad (*Alosa alosa*), Scotland, July.

Contracæcum auctum (Rudolphi, 1802).

Topknot (*Zeugopterus punctatus*), Hastings ; Ribbon-fish (*Regalecus glesne*), Scottish coast, March ; Angler (*Lophius piscatorius*), Yorkshire coast ; (?) Ballan wrasse (*Labrus maculatus*), Isle of Mull.

Contracæcum clavatum (Rudolphi, 1809).

Cod (*Gadus morrhua*), North Sea ; Arran, September ; Fifeshire ; Yorkshire, April ; Sea-trout (*Salmo trutta*), Scotland ; Halibut (*Hippoglossus hippoglossus*), North Sea ; Haddock (*Gadus æglefinus*), North Sea ; Pollack (*Gadus pollachius*), S. Devon ; Hake (*Merluccius merluccius*), S. Devon ; Bublial (*Cottus bubalis*), Norfolk ; Father-lasher (*Cottus scorpius*), S. Devon ; Mackerel (*Scomber scomber*), Guernsey, July ; Whiting (*Gadus merlangus*), Guernsey, July.

Contracæcum microcephalum (Rudolphi, 1809).

Bittern (*Botaurus stellaris*), Sussex.

Contracæcum rigidum (Rudolphi, 1809).

Angler (*Lophius piscatorius*), Yorkshire.

Contracæcum spiculigerum (Rudolphi, 1809).

Cormorant (*Phalacrocorax carbo*), N. Wales ; Shag (*Phalacrocorax graculus*), Scilly Is.

Cosmocerca ornata (Dujardin, 1845).

Frog (*Rana temporaria*), Cambridgeshire.

Crassicauda crassicauda (Creplin, 1829).

Cuvier's whale (*Ziphius cavirostris*), Co. Wexford.

Cucullanus cirratus, Müller, 1780.

Plaice (*Pleuronectes platessa*), Wales.

Cucullanus truttae, Fabricius, 1794.

Trout (*Salmo trutta*), Hampshire, September.

Cystidicola farionis, Fischer v. Waldheim, 1798.

Trout (*Salmo trutta*), Hertfordshire; Hampshire, September.

Cystidicola impar (Schneider, 1866).

Trout (*Salmo trutta*), Hampshire.

Epomidiostomum uncinatum (Lundahl, 1848).

Mallard (*Anas boschas*), Outer Hebrides, September.

Eustrongylides mergorum (Rudolphi, 1809).

Little grebe (*Podiceps fluviatilis*), Yorkshire, November.

Eustrongylides sp. (larva) [*"Filaria bicolor"*].

Trout (*Salmo trutta*), N. Wales; Arran, August and September.

Eustrongylides sp. (immature).

Black-headed gull (*Larus ridibundus*), Surrey, January.

Filaroides mustelarum (Rudolphi, 1809).

Weasel (*Mustela nivalis*), S. Wales; Cambridgeshire;
Stoat (*Mustela erminea*), Cambridgeshire.

Graphidium strigosum (Dujardin, 1845).

Rabbit (*Oryctolagus cuniculus*); Common hare (*Lepus europæus*), Dumfriesshire; Leicestershire.

Habronema seurati, Skrjabin, 1917.

Hobby (*Falco subbuteo*), Hampshire.

Hadjelia truncata (Creplin, 1825).

Hoopoe (*Upupa epops*), Yorkshire.

Halocercus delphini, Baylis & Daubney, 1925.

Common dolphin (*Delphinus delphis*).

Halocercus inflexocaudatus (v. Siebold, 1842).

Porpoise (*Phocæna phocæna*).

Halocercus lagenorhynchi, Baylis & Daubney, 1925.

White-beaked dolphin (*Lagenorhynchus albirostris*), North-umberland.

Heligmosomoides polygyrus (Duj.), Boulenger, 1922.

Field-vole (*Microtus agrestis*), near Oxford.

Heterakis gallinæ (Gmelin, 1790).

Pheasant (*Phasianus colchicus*) ; Partridge (*Perdix perdix*).

Heterakis spumosa, Schneider, 1866.

Brown rat (*Rattus norvegicus*), Cambridgeshire.

Nematospiroides dubius, Baylis, 1926.

Wood-mouse (*Apodemus sylvaticus*), near Oxford.

Oswaldocruzia filiformis (Goeze, 1782).

Toad (*Bufo vulgaris*), Surrey, April ; Hampshire, June ; Frog (*Rana temporaria*), Cambridgeshire, &c. ; Smooth newt (*Molge vulgaris*), Cambridgeshire.

Oxysomatium brevicaudatum (Zeder, 1800) (= *longespiculum*, Railliet & Henry, 1915).

Slow-worm (*Anguis fragilis*), Oxfordshire, June ; Devon, July ; Toad (*Bufo vulgaris*), Hampshire, June.

Pussalurus ambiguus (Rudolphi, 1819).

Rabbit (*Oryctolagus cuniculus*).

Porrocæcum crassum (Deslongchamps, 1824).

Mallard (*Anas boschas*), Hertfordshire.

Porrocæcum depressum (Zeder, 1800).

Kestrel (*Falco tinnunculus*), Suffolk, November ; Sparrowhawk (*Accipiter nisus*), Fifeshire, January.

Porrocæcum ensicaudatum (Zeder, 1800).

Song-thrush (*Turdus musicus*), Surrey ; Blackbird (*Turdus merula*), Hertfordshire, &c. ; Starling (*Sturnus vulgaris*), Hertfordshire ; Devon, January ; Pembrokeshire, February ; Wales ; Rook (*Corvus frugilegus*), Wales ; Hertfordshire ; Missel-thrush (*Turdus viscivorus*), Hertfordshire, January.

Porrocæcum semiteres (Zeder, 1800).

Lapwing (*Vanellus vanellus*), Surrey.

Porrocaecum spirale (Rudolphi, 1797).

Little owl (*Athene noctua*), N. Wales ; Somerset ; Barn-owl (*Strix flammea*), Kent.

Proleptus obtusus (Dujardin, 1845).

Spotted dogfish or Rough hound (*Scyliorhinus canicula*), S. Devon ; Smooth hound (*Mustelus lævis*), S. Devon.

Protospirura muris (Gmelin, 1790).

House-mouse (*Mus musculus*), Lancashire ; Middlesex, May.

Pseudalius inflexus (Rudolphi, 1809).

Common porpoise (*Phocæna phocæna*).

Raphidascaris cristata (v. Linstow, 1872).

Eel (*Anguilla anguilla*), Worcestershire.

Rhabdias bufonis (Schrank, 1788).

Frog (*Rana temporaria*), near Birmingham, &c.

Rhabdias dujardini (Maupas, in Seurat, 1916).

Slow-worm (*Anguis fragilis*), N. Devon, July.

Rhabdias entomelas (Dujardin, 1845).

Slow-worm (*Anguis fragilis*), N. Devon, July.

Serratospiculum tendo (Nitzsch, in Giebel, 1857) [= *attenuatum* (Rudolphi)].

Peregrine falcon (*Falco peregrinus*), February.

Spirura talpæ (Gmelin, 1790).

Mole (*Talpa europæa*), Surrey, January.

Stenurus globicephalæ, Baylis & Daubney, 1925.

Ca'ing whale or Blackfish (*Globicephala melena*), Firth of Forth.

Stenurus minor (Kuhn, 1829).

Porpoise (*Phocæna phocæna*), Fifeshire.

Streptocara crassicauda (Creplin, 1829).

Shelduck (*Tadorna tadorna*), Outer Hebrides, September.

Streptocara ? stellæ-polaris (Parona, 1901).

Fulmar petrel (*Fulmarus glacialis*), North Sea, January ; Storm-petrel (*Thalassodroma pelagica*), Norfolk, November.

Strongylacantha glycirrhiza, v. Beneden, 1873.

Greater horseshoe-bat (*Rhinolophus ferrum-equinum*),
Somerset, December.

Subulura suctoria, Molin, 1860.

Nightjar (*Caprimulgus europæus*), Wales.

Syngamus merulæ, Baylis, 1926.

Blackbird (*Turdus merula*), Hertfordshire.

Syngamus trachea (Montagu, 1811).

Pheasant (*Phasianus colchicus*); Rook (*Corvus frugilegus*),
Hertfordshire; Starling (*Sturnus vulgaris*), Hertfordshire;
Jackdaw (*Corvus monedula*), Hertfordshire; Norfolk; Magpie
(*Pica pica*), Hertfordshire.

Syphacia obvelata (Rudolphi, 1802).

Brown rat (*Rattus norvegicus*), near Cambridge; Wood-
mouse (*Apodemus sylvaticus*), near Oxford; Surrey, De-
cember.

Torynurus convolutus (Kuhn, 1829).

Common porpoise (*Phocæna phocæna*).

Toxocara mystax (Zeder, 1800).

Wild cat (*Felis sylvestris*), Perthshire, December.

Trichostrongylus pergracilis (Cobbold, 1873).

Red grouse (*Lagopus scoticus*), Scotland.

Trichostrongylus retortæformis (Zeder, 1800).

Scotch mountain-hare (*Lepus timidus scoticus*), October,
December.

Trichostrongylus tenuis (Mehlis, in Creplin, 1846).

Partridge (*Perdix perdix*).

Tropisurus ? fissispinus (Diesing, 1861).

Scaup-duck (*Nyroca marila*), Outer Hebrides, October;
Common scoter (*Oidemia nigra*), Norfolk, November.

Viannaia depressa (Dujardin, 1845).

Common shrew (*Sorex araneus*), near Oxford.

ACANTHOCEPHALA.

Acanthocephalus lucii (Müller, 1779).

Eel (*Anguilla anguilla*).

Bolbosoma porrigens (Rudolphi, 1814).

Lesser rorqual (*Balænoptera acutorostrata*), Lincolnshire, September.

Centrorhynchus aluconis (Müller, 1780).

Tawny owl (*Strix aluco*).

Centrorhynchus teres (Westrumb, 1821) (?).

Jackdaw (*Corvus monedula*), Hertfordshire.

Echinorhynchus appendiculatus, Westrumb, 1821.

Larva: Common shrew (*Sorex araneus*), near Oxford.

Echinorhynchus rosai, Porta, 1910.

Hedgehog (*Erinaceus europæus*), Cambridgeshire, May.

Echinorhynchus salmonis, Müller, 1784.

Eel (*Anguilla anguilla*), Worcestershire.

Echinorhynchus truttae, Schrank, 1788.

Trout (*Salmo trutta*), Buckinghamshire; Hampshire; Hertfordshire; Derbyshire, &c.

Filicollis anatis (Schrank, 1788).

Mallard (*Anas boschas*), Hertfordshire; Scaup-duck (*Nyroca marila*), Kirkeudbrightshire, October.

Neoechinorhynchus rutili (Müller, 1780).

Trout (*Salmo trutta*), Hampshire, September.

Plagiorhynchus lanceolatus (v. Linstow, 1876).

Ringed plover (*Ægialitis hiaticula*).

Polymorphus boschadis (Schrank, 1788).

Mute swan (*Cygnus olor*), Cambridgeshire, October; Shelduck (*Tadorna tadorna*), Outer Hebrides, September; Gadwall (*Chaulelasmus streperus*), Outer Hebrides, October; Scaup-duck (*Nyroca marila*), Kirkcudbrightshire, October.

Pomphorhynchus lævis (Zoega, in Müller, 1776).

Roach (*Rutilus rutilus*), Oxfordshire, June.

Prosthiorhynchus transversus (Rudolphi, 1819).

Starling (*Sturnus vulgaris*), Devon, January.

XLII.—On the East-African Mongoose described as
Galeriscus jacksoni. By OLDFIELD THOMAS.

IN 1894, led astray by the Musteline—or, rather, Maline—make-up of a skin without skull from Kenya Colony, I described as a new genus of the Mustelidæ, under the name of *Galeriscus jacksoni*, an animal whose type on being remade lost its deceptive Musteline appearance, and proved to be a mongoose of the family Viverridæ. It was said to be—first by Dr. Matschie, and then by Mr. Pocock—the same as the fine West-African mongoose known as *Bdeogale nigripes*, Puch., and this reference of *Galeriscus jacksoni* to *Bdeogale nigripes* has continued current until the present time, the animal being so rare that no one has been able to make a direct comparison of it with its West-African ally.

Now, however, the British Museum has received several specimens, including two skulls, from Mount Kenya, collected by Mr. Alan Insole, and I have therefore taken the opportunity of comparing it with *Bdeogale nigripes* and the other members of the genus *Bdeogale*.

Firstly, as to the species. Although very closely allied to *nigripes*, *jacksoni* would appear to be distinct both by its smaller size, as evidenced by the skull-measurements, by its different coloration, the head, throat, and inguinal region being much whiter, and by its markedly longer fur. The teeth are relatively a little larger.

The following are the measurements of adult female skulls of the two forms, the first measurement in each case being that of *jacksoni*, the second of *nigripes*:—

Greatest length 109, 117; condylo-basal length 105, 116.5; zygomatic breadth 54, 60; mastoid breadth on bullæ 38, 44; palatal length 62, 68; breadth of bulla 13, 15.

Our largest skull of *nigripes*, probably male, has a greatest length of 128 mm.

Then as to the genus. On laying out a series of skins of the two groups, *nigripes* and *jacksoni* on the one hand and *crassicauda* and its allies on the other, there is a difference of general appearance and coloration so conspicuous that if such a comparison had ever before been made a suspicion of the generic distinction of the two must have arisen. The true *Bdeogale* (smaller, more slenderly built, with brown body and black bushy tail) contrasts greatly with *nigripes* and *jacksoni* (larger, more heavily built, with hoary grey body and prominently white tapering tail). For these latter, of course, the name *Galeriscus* is available.

The skull of *Galeriscus*, except for its much greater size, is essentially as in *Bdeogale*, but the teeth are of different shape and structure, the teeth being rounder, less elongated transversely, without the more triangular, somewhat *Ichneumia*-like shape of those of *Bdeogale*, the difference being especially marked in m^2 . There is, moreover, in unworn teeth a remnant of a cuspidate structure of the inner lobe (especially visible in m^1), which has completely disappeared in favour of an angular ridge or commissure in *Bdeogale*.

The conclusion at which I arrive is therefore that *Galeriscus*, with its genotype *G. jacksoni*, and its West-African congener *G. nigripes*, ought to be considered as distinct from *Bdeogale*, whose genotype is *B. crassicauda*, with a doubtful number of other forms, those described bearing the names of *puisa*, *tenuis*, and *omnivora*.

XLIII.—*Bees collected in Siberia in 1927.*

By T. D. A. COCKERELL, University of Colorado.

THE bees collected in the region of Lake Baikal in 1927 prove to be very similar to those of Europe, many of the species extending practically unaltered from Baikal to the Atlantic. The same thing is true of the other insects and the flowering plants. This is the greatest extension of an essentially homogeneous biota in the world. East of Baikal, and especially in the Maritime Province, the fauna changes, and there are many more endemic species.

Melecta diacantha, Eversmann.

Smolenschina, Siberia, Aug. 17 and 21 (*Cockerell*).

Described from "Transural," but since recorded from Irkutsk.

Phiarus abdominalis, Eversmann.

Irkutsk, Siberia, July (*W. P. Cockerell*).

The British Museum has one labelled "Baical."

Phiarus angarensis, sp. n.

♂.—Closely allied to *P. melectoides*, Smith (*scriptus*, Gerst.), but eyes black, more converging above; antennæ entirely black, not expanded at end; white bands on abdominal segments 2 to 6 entire.

Ust-Balei, on the Angara River, Siberia, July (*Cockerell*).

Meliturga clavicornis, Latreille.

Ust-Balei, July (*Cockerell*).

Dioxys tridentata, Nylander.

Kychtak, near Irkutsk, Siberia, Aug. 20 (*Cockerell*).

Stelis aterrima melanura, Cockerell.

This is the dark variety described from the Maritime Province. Ust-Balei, July, and Irkutsk, July (*Cockerell*).

Cœlioxys rufescens, Lepeletier.

Ust-Balei, July (*Cockerell*).

Cœlioxys lanceolata, Nylander.

Archan, Siberia, August, and Baikal University Station, August (*Cockerell*). The latter locality is the Biological Station of the University of Irkutsk on Lake Baikal.

The Archan specimen was at pink orchid flowers, Aug. 11.

Cœlioxys acuminata, Nylander.

Baikal University Station, Kychtak and Smolenschina (*Cockerell*).

Pasites maculatus, Jurine.

Smolenschina, Aug. 17 (*Cockerell*).

Panuginus niger, Nylander.

♀, Irkutsk, July (*Cockerell*).

This is the type of the genus, not seen in recent years by entomologists. The first recurrent nervure meets the intercubitus.

Dasypoda plumipes, Panzer.

Ust-Balei, July (*Cockerell*).

Haliotoides dentiventris, Nylander.

Smolenschina, Aug. 21 (*Cockerell*).

Melitta microstigma, Eversmann.

♂, Smolenschina, Aug. 21 (*Cockerell*).

This is another lost species, described from "Transural." I can extend the description by the following data: flagellum strongly dentate beneath, antennæ entirely black; no fuscous hair on thorax above; sixth ventral segment of abdomen without keel; first abdominal segment with long white hair, second and third with shorter white hair, fourth and fifth with conspicuous black hair; white hair-bands very narrow. *M. wankowiczi*, Rad., ♀, is similar in general aspect, but flagellum is bright red beneath except at base, and there is fuscous hair on the thorax above.

Anthophora atroalba, Lepeletier.

Anthophora acervorum, Linnaeus.

Both at Baikal University Station (*Cockerell*).

Anthophora borealis, Morawitz.

Both sexes, Ust-Balei. Tibeltje, at flowers of a species of Labiatæ; and Irkutsk (*Cockerell*).

Known from the Leningrad district to the Caucasus.

Clisodon furcatus terminalis, Cresson.

Both sexes, Irkutsk, Ust-Balei (both sexes), Baikal University Station, and Listvenitschnoe (*Cockerell*).

I cannot distinguish this from the form found on the Maritime Province and in America, but it is not sharply distinguished from typical *C. furcatus*.

Nomada roberjeotiana, Panzer.

Five females from Smolenschina, August (*Cockerell*).

The British Museum has one labelled "Angara." Closely related or at least similar to this is a series of four other species, now first described. They agree with *N. roberjeotiana* in size, lack of conspicuous hair, simple mandibles, absence of spines on anterior coxæ, and basal nervure nearly or quite meeting nervulus (except in the case of *N. scheviakovi*, in which the basal nervure goes considerably basad of nervulus). They all agree (but differ from *N. roberjeotiana*) in the scutellum with two cream-coloured or yellowish-white spots, and postscutellum all black (except a very small obscure median spot in *N. scheviakovi*).

The whole series may be separated as follows:—

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| Scutellum red | <i>roberjeotiana</i> , Pz., ♀. |
| Scutellum black with two cream-coloured spots .. | 1. |
| 1. Tegulæ bright ferruginous; clypeus mainly red;
legs red | <i>belikovi</i> , Ckll., ♀. |
| Tegulæ cream-colour | 2. |
| 2. Antennæ entirely bright ferruginous, including the
whole of the scape; pale yellow lateral face
marks, and spot on supraclypeal area | <i>scheviakovi</i> , Ckll., ♀. |
| At least scape largely black; no spot on supra-
clypeal area | 3. |
| 3. Flagellum all red; face black with a cream-coloured
patch on clypeus | <i>olhae</i> , Ckll., ♀. |
| Flagellum not all red; face not so marked | 4. |
| 4. Clypeus black, lower margin narrowly reddish;
scape bright red in front | <i>jasnitskii</i> , Ckll., ♀. |
| Clypeus with a cream-coloured band; males..... | 5. |
| 5. Apical plate of abdomen entire; flagellum mainly
dark | <i>jasnitskii</i> , Ckll. |
| Apical plate deeply notched; flagellum clear red
beneath | <i>belikovi</i> , Ckll. |

All the females were collected at Smolenschina in August; the males were taken at Irkutsk. Male *N. jasnitskii* was at flowers of *Sedum*, July 22.

Nomada belikovi, sp. n.

♀ (type).—Length 8.7 mm.

Black, with the following parts clear ferruginous, clypeus except upper margin, lower corners of face broadly, slender lines along orbits nearly to level of antennæ, labrum (which is not dentate), mandibles except apex, antennæ entirely (third joint distinctly shorter than fourth), tegulæ, and legs (except most of coxæ, and large black patch on hind femora behind); narrow upper border of prothorax, tubercles, two large spots on scutellum, all yellowish white. Abdomen fusiform, black, first segment with two large round red spots on disc, having dull red extensions to lateral margins, second with very large pyriform cream-coloured marks, third with narrower marks, fourth with a band interrupted laterally and very narrowly in middle, fifth with a large transverse patch, followed by a pale fringe; venter red, broadly and suffusedly banded with black. Head broad; mesothorax dull and rugose; mesopleura densely rugose, with an obscure red mark; scutellum very prominently bigibbous; area of metathorax with basal half rugose. Wings clouded with brown, stigma ferruginous, nervures fuscous; second cubital cell large, receiving recurrent nervure in middle. Abdomen shining.

Smolenschina.

♂.—Face covered with silvery hair; broad lower margin of clypeus, lower corners of face, labrum, mandibles except apex, the broad scape in front, small marks on upper border of prothorax. Tubercles, tegulæ, small spots on scutellum, large marks at sides of second and third abdominal segments, and bands on fourth to sixth (interrupted on fourth) all cream-colour; first abdominal segment with obscure red spots; third antennal joint much shorter than fourth; first six antennal joints black above. Wings hyaline with dusky apex, nervures ferruginous; area of metathorax conspicuously rugose at base; mesopleura all black; hind femora largely black in front and behind. This male collected at Irkutsk in July (*W. P. Cockerell*) may perhaps represent a distinct species, and is placed here with some hesitation.

The species is named after Ivan Belikoff, Secretary of the Geological Committee at Irkutsk, who introduced me to the exceedingly rich Smolenschina locality.

Nomada jasnitkii, sp. n.

♀ (type).—Length about 9 mm.

Black, with very narrow lower margin of clypeus, labrum, mandibles except apex, scape (except rather narrowly behind), joints 2 and 3 in front, and basal half of flagellum beneath very suffusedly, all ferruginous; third antennal joint rather longer than fourth; two marks on prothorax above, tubercles, tegulæ, and two spots on scutellum, all yellowish white; mesothorax dull

and rugose, with glistening points between the punctures; scutellum strongly bigibbous; mesopleura very densely punctured in lines; area of metathorax shining below, above dull but not coarsely rugose; legs red, the femora entirely red. Wings hyaline, brownish apically; stigma dull reddish, nervures fuscous; second cubital cell receiving recurrent nervure much beyond middle. Abdomen shining, very finely punctured; small spots at side of first segment, very large transverse marks on second, smaller marks on third, band on fourth very broadly interrupted laterally and narrowly in middle, and broad band on fifth, all yellowish white; venter black, with a short transverse light mark on third segment.

Two specimens; Smolenschina, Aug. 17 (*W. P. Cockerell*) and 21 (*Cockerell*).

♂.—Face covered with silvery hair; lower margin of clypeus, lower corners of face, labrum, base of mandibles, upper border of prothorax, tubercles, tegulæ, rather small spots on scutellum, broadly interrupted band on first abdominal segment, large marks on second, smaller on third, marks on fourth almost hidden by margin of third, and continuous bands on fifth and sixth, all yellowish white; scape obscurely yellowish in front; flagellum black, obscurely reddish beneath; third antennal joint shorter than fourth. Legs red, the femora black except apically; apical plate of abdomen entire, all black (notched, and broadly yellowish white in middle in *N. belikovi*). Two at Irkutsk, July (*Cockerell*).

The reference of the male to this species rests on a high degree of probability only. Named after the excellent biologist of Irkutsk, W. Jasuitski.

Nomada schewiakovi, sp. n.

♀.—Length about 10 mm.

Black, with these parts ferruginous, clypeus except upper margin, labrum, mandibles except apex, antennæ entirely, and legs except coxæ and part of trochanters; yellowish white are long-cuneiform lateral face-marks, spot on supraclypeal area, interrupted band on prothorax, tubercles, tegulæ, two spots on scutellum, two elongate marks on metathorax, broadly interrupted band on first abdominal segment, bands on second and third attenuate in middle, and entire bands on fourth and fifth; venter marked with white on second and following segments; third antennal joint long, nearly as long as fourth; mesothorax and mesopleura dull and rugose; area of metathorax dull, the basal part with obtuse longitudinal plicæ; scutellum not very strongly bigibbous. Wings brownish, stigma bright ferruginous; second cubital cell receiving recurrent nervure a little before middle. Abdomen shining, very finely punctured. One at Smolenschina, Aug. 17 (*Cockerell*).

Dedicated to W. Schewiakoff, the distinguished zoologist of the University of Irkutsk.

Nomada olhae, sp. n.

♀.—Length about 9·5 mm.

Black, face black, with a round yellowish-white spot on upper part of clypeus; labrum black, the lower part pallid; mandibles pale yellow except apically; scape obscure yellowish in front and broadly black behind, flagellum entirely clear red; third antennal joint longer than fourth; mesothorax and mesopleura densely punctured but glistening; interrupted band on swollen upper margin of prothorax, tubercles, tegulae (except brown basal spot and margin) and very large spots on scutellum, all yellowish white; scutellum strongly but broadly bigibbous; area of metathorax not specially roughened or sculptured basally; lateral corners of metathorax with conspicuous short white hair; metathorax below the enclosure shining. Legs except coxæ and part of trochanters clear red, hind tibiae not bidentate at apex. Abdomen very minutely punctured, first segment all black, second to fourth with lateral cream-coloured marks, those on second smaller than those on third, fifth with a broad band; venter entirely black.

One at Smolenschina, Aug. 17 (*Cockerell*).

The name is derived from the River Olha, which flows close to the locality*.

Bombidæ.

The following Bombidæ of the 1927 Expedition were kindly determined for me by Mr. Vladimir B. Popov:—

Psithyrus campestris, Panzer. Smolenschina.

P. barbutellus, Kirby. Smolenschina.

Bombus hypnorum, Linnæus. Leningrad, Archan.

B. agrorum, Fabricius. Archan, Irkutsk, Smolenschina.

B. agrorum tricuspis, Schmiedeknecht. Archan, Smolenschina, Baikal Railway Station.

B. lucorum, Linnæus. Ust-Balei.

B. muscorum, "Linnæus," auctt. Ust-Balei.

B. equestris, Fabricius. Ust-Balei.

B. hypnorum calidus, Erichson. Archan. Described from Siberia.

B. sichelii, Radoszkowski. Baikal University Station, Smolenschina, Ust-Balei. Described from the Amur.

B. schrencki, Morawitz. Baikal Railway Station, Baikal University Station, Archan. Described from the Amur.

* While on Siberian *Nomada* it may be well to add a note on *N. ornata*, Eversmann, described from the Transural country. Lozinski found what purported to be *N. ornata* from Irkutsk in the Radoszkowski Collection, and it was *N. roberjeotiana*. But Eversmann in his original account clearly separates the two, *N. ornata* having the first abdominal segment red-banded, not all red, and apparently all the thoracic markings yellow.

- B. patagiatus*, Nylander. Archan, Ust-Balei, Baikal Railway Station, Smolenschina. Described from Siberia.
B. superequester, Skorikov. Smolenschina, Baikal Railway Station, Tibeltye, Irkutsk.
B. modestus, Eversmann. Archan, Baikal University Station.
B. consobrinus, Dahlbom. Irkutsk, one in Dr. Schewiakoff's garden (*W. P. Cockerell*).

Anthidium dinurum, Cockerell.

Females from Ust-Balei and Irkutsk. Males from Smolenschina (sixth abdominal segment all black) and Irkutsk (sixth segment with yellow spots). This is a species described from the Maritime Province, and I should have expected to see the related *A. florentinum* taking its place in the Baikal region.

Anthidium baicalense, sp. n.

♂.—Agreeing in size and form with *A. punctatum*, Latr., but hair of thorax above fox-red, the colour deeper anteriorly; face-markings lemon-yellow, the lateral marks above forming a right angle with orbit; antennæ longer, scape all black; tegulæ bright ferruginous; knees and tibiæ red, tarsi cream-colour, reddish at apex; fifth abdominal segment with the band continuous, and light patch on sixth not divided in middle.

Baikal Railway Station, July 31 (*Cockerell*).

A. punctatum, var. *fulvipes*, Friese (not *A. fulvipes*, Fab.), has red legs, but otherwise agrees with *A. punctatum*. *A. greyi*, Rad., described from Siberia near the Chinese border, and listed as a synonym of *A. punctatum*, has the hair on thorax above red as in our insect, but the tegulæ and legs are yellow, and the scape is partly yellow.

Anthidiellum pauperculum, sp. n.

♂.—Rather like *Anthidium oblongatum*, Latr., to which it runs in Friese's table, but smaller (anterior wing 5.8 mm.), with well-defined pulvilli and second recurrent nervure going far beyond second cubital cell. It also differs by the white (or creamy white) instead of yellow markings, but agrees in having a little tooth in middle of hind margin of sixth abdominal segment, but this segment is not produced into teeth at sides. Thus there is actually no affinity.

Black, with clypeus and parallel-sided lateral face-marks (extending up to level of antennæ), the broad mandibles except apex, elongate spot above each eye, two widely separated stripes on anterior border of mesothorax, spot on tubercles, small spot in front of the black tegulæ, curved stripes before the obtusely subangular sharp-edged posterior lobes of scutellum, and ten rather large spots on abdomen, all yellowish white; the spots on the first two segments are lateral, on the following three subdorsal, the two apical segments are entirely black; hair of head and thorax

scanty, white; antennæ entirely black; thorax very densely punctured; a tuft of white hair below the base of each wing. Wings dilutely smoky, darker in marginal cell and beyond; nervures black. Femora black, knees, tibiæ, and tarsi pale yellow suffused with red, but tibiæ mainly black behind. Sixth abdominal segment with a small median denticle, seventh with a large median spine or process, margins of both these segments pallid. The axillæ are entirely black.

Smolenschina, Siberia, Aug. 21 (*Cockerell*).

The real affinity is with *A. strigatum* (Panzer), but, owing to the reduced pale markings, it has a very different appearance.

Eucera longicornis, Linnæus.

♀.—Irkutsk, July (*Cockerell*).

The only Eucerine found in the Baikal region. Later on, in company with Professor Kuznetsov-Ugamsky, I obtained two females of a *Tetralonia* at Kujluk, near Kashkent, Sept. 7. This proves to be *T. fuscipes*, Morawitz. It is closely related to *T. salicariæ*, Lep., which goes as far east as Helenendorf in the Transcaucasus (specimen in British Museum, det. Friese).

Osmia (Acanthosmia) platyodonta, sp. n.

♂.—Length 9 mm. with abdomen curled downward, anterior wings 6 mm.

Black, narrow and cylindrical, with very scanty white pubescence, denser and conspicuous on scutellum, sides of thorax, and cheeks below; a long white fringe at apex of clypeus, and a dense pure white tuft extending downward on each side of clypeus. Head (seen from in front) subcircular, a little longer than broad; mandibles and antennæ unmodified, black; clypeus densely punctured and dull, the upper part with a short slender shining line; vertex polished and sparsely punctured; mesothorax shining, with well-separated punctures, scutellum densely punctured; area of metathorax shining; tegulæ black, brownish on margin. Wings hyaline, suffused with reddish brown, stigma and nervures black; basal nervure falling some distance short of nervulus; first recurrent joining second cubital cell very near base, about half as far as second from apex. Legs slender, with thin pale hair, spurs whitish; abdomen narrow, strongly curved downward, shining but well punctured; no distinct bands, but thin fringes on lateral hind margins of segments; second ventral segment with a very large antero-posteriorly flattened process, appearing conical in lateral view, and not directed caudad; apex broadly truncate with salient corners, as in *O. mocsaryi*, Friese, only broader, with the angles more acute.

Irkutsk, Siberia, at flowers of *Campanula*, July (*Cockerell*).

In my key in Bees C, p. 598, this runs out at 3, having black tegulæ and shining mesothorax. It is perhaps nearest to *O. macrodonta*, Ckll., but quite distinct.

Osmia (Acanthosmia) archanensis, sp. n.

♀.—Length about 10 mm.

Ventral scopa pure white. The aspect is exactly that of *O. platyodonta*, but the species must be distinct, as the clypeus is shining though well punctured, the basal nervure exactly meets the nervulus (as in *O. macrodonta*), and the first recurrent ends as far from base of second cubital cell as second from apex. They agree in the shining area of metathorax, black tegulæ, antennæ, and mandibles, and many other characters. The margin of the last abdominal tergite is covered with white hair.

Archan, Siberia, August (*Cockerell*). Archan is in the Buriat country.

Megachile willughbiella, Kirby.

♂.—Baikal Univ. Station, Aug.; ♀ same data (*Cockerell*), and Irkutsk, July (*W. P. Cockerell*).

Megachile ligniseca, Kirby.

♂.—Baikal Univ. Station and Kychtak, Aug. (*Cockerell*).

Megachile maackii, Radoszkowski.

♂.—Baikal Univ. Station, Aug. (*Cockerell*).

This is not a synonym of *M. nigriventris*, Schenck, though related. It has been recorded from Irkutsk.

Megachile baleina, sp. n.

♂ (type).—Length 15 mm.

A large robust species, with the aspect of *M. ligniseca*, *M. lagopoda*, and *M. maritima*, but quite distinct from these; hair of head and thorax abundant, very pale fulvous, not mixed with black, a pure white patch on lower part of cheeks; mandibles very broad, obtusely angulate below; cheeks broad, rugoso-punctate, not polished; face densely covered with cream-coloured hair; antennæ entirely black, simple at end; mesothorax densely rugoso-punctate, densely hairy; scutellum shining between punctures; tegulæ black, faintly reddish posteriorly. Wings very dilute brown, stigma red, nervures dark; first recurrent nervure ending only a short distance beyond first intercubitus. Anterior coxæ with very long spines; their femora pale red above, with apex black, and a well-defined keel on outer side (style of *M. willughbiella*); beneath the anterior femora have a white band, deeply incised anteriorly near base; anterior tibiæ very robust, black, the apex broadly cream-colour; their tarsi cream-colour (reddened apically), greatly broadened, the basitarsi anteriorly with a fringe of copper-red hair; posterior fringe long, white, black at end; middle and hind femora, and hind tibiæ, much swollen; hind tarsi stout, the basitarsi short, last joint very long; claws very stout, curved and bidentate at end. Abdomen broad,

first three segments with pale fulvous hair; fourth and fifth with fulvous at base, but black beyond; white hair-bands on segments 2 to 4, that on 2 failing in middle; fifth with a very thin band; sixth segment retracted, the transverse keel broadly and deeply emarginate, and slightly undulate on each side of emargination; sixth segment with a small tooth at each side of apical margin.

♀.—Length about 16 mm.

Similar in aspect, hair of head and thorax rather lively fulvous above, with no dark hairs; mandibles elongate and produced, with very broad cutting-edge, the teeth feeble; clypeus convex, densely punctured, the upper part with a smooth median line; middle femora stouter than hind; hind basitarsi much broadened; hind tarsi with very bright copper-red hair on inner side; first two abdominal segments with thick pale fulvous hair; 3 to 5 with black hair, and apical white bands; sixth straight in lateral profile, not evidently hairy; ventral scopa very bright red, pallid at base, black on last two segments.

Ust-Balei, on River Angara, July, 2 ♂, 1 ♀ (*Cockerell*).

Closely related to *M. willughbiella*, but much more robust, with apical joint of male antennæ not broadened at end. *M. lagopoda* differs at once by black hair on vertex, and clypeus flattened and shining.

Megachile angarensis, sp. n.

♀ (type).—Length about 12·5 mm.

Similar in nearly all respects to *M. analis*, Nyl., including such characteristic features as the sparsely punctured shining disc of mesothorax, the obtuse median swelling on scutellum, and the short pale hair on last abdominal tergite, but easily distinguished by the ventral scopa, which is black with extreme base white, and some red in middle behind the white; also by the abdominal tergites, the third to fifth having scanty black hair, and thin white fringes. Hair of head and thorax dull white, but vertex with conspicuous black hair.

♂.—Length 12 mm.

Similar to *M. analis*, but hair of head and thorax white, a little dark on vertex, and abdominal segments 3 to 5 with white hair-bands, dense and clear in middle of 4 and 5. The anterior femora are red at end, instead of cream-colour, but the basitarsi are cream-colour.

One of each sex, Baikal Railway Station, July 31 (*Cockerell*).

The locality is just where the Angara River flows out of Lake Baikal. According to the very brief description, *M. melanogaster*, Ev., seems similar.

Megachile kychtacensis, sp. n.

♀.—Length 12 mm.

Another species associated with *M. analis* on account of the appressed white hair on last abdominal tergite, but ventral scopa

entirely white, and the bulging scutellum without any median tubercle. Also, the mesonotum is very densely rugoso-punctate all over. Hair of face, cheeks and sides of thorax pure white, of thoracic dorsum thin but lively ferruginous, strongly contrasting; clypeus convex, densely punctured, shining between punctures in middle; antennæ and tegulæ black; area of metathorax shining with a sericeous surface. Wings brownish, nervures black. Tibiæ broad, with dense white hair on outer side; hind basitarsi broadened, not parallel-sided, with red hair on inner side. Abdomen broad and short, with thin pale hair, and no distinct bands; first segment with long white hair, but not second.

Kyhtak, near Irkutsk, Aug. 20 (*Cockerell*).

The white scopa would seem to ally it with the group of *M. argentata*, but it is not similar to that species or its allies. *M. lucidula*, Mocs., from Siberia, has a white scopa, but is a smaller bee resembling *M. apicalis*.

In the British Museum I found a female *M. analis albidula*, Friese, labelled "Amoor." The hair of the mesothorax is pale golden; the ventral scopa is white at base, then red, but the last three segments black; the abdomen has bands on long pale hair.

Megachile circumcincta, Kirby, var. *lactescens*, nov.

♀.—With white hair on face, and very clear white hair on pleura; wings strongly brownish.

Baikal Univ. Station, Aug. (*Cockerell*).

In the British Museum is a female from Rantasalmi (Saunders collection) which has white hair on face and pleura, but the wings are not darkened.

Megachile lapponica, Thomson, subsp. *baicalica*, subsp. n.

♀.—Length about 12 mm.

Rather narrow, black, including mandibles, antennæ, and tegulæ; hair of head and thorax long and shaggy, mostly greyish white, but dark brown on front, vertex, and discs of mesothorax and scutellum; head not very broad; mandibles broad, quadridentate; clypeus convex, very densely punctured, lower margin slightly irregular; cheeks broad, glistening; mesothorax glistening, with close shallow punctures, scutellum dull; area of metathorax very short, dull. Wings faintly brownish, nervures black, stigma dark red in middle. Legs ordinary, hind basitarsi narrow, not nearly as broad as tibiæ (good character to separate it from *M. versicolor*), hair on inner side of tarsi very bright red, spurs red. Abdomen shining, first two segments with long white hair, the others with short black hair; segments 2 to 5 with pure white hair-bands, weak or failing in middle except on 5; last tergite straight in lateral view with a small amount of obliquely out-standing hair; ventral scopa bright red, entirely black on last two segments.

Baikal University Station, Aug., Smolenschina, Aug. 17 (*Cockerell*). The first is the type-locality.

The British Museum has a specimen labelled "Amoor," acquired in 1871.

This is certainly near *M. lapponica*, but the male may prove it to be specifically distinct. *M. melanota*, Pérez, has a broader abdomen, with strongly hairy last tergite and less densely punctured clypeus.

Megachile lapponica, var. *kurbati*, nov.

♀.—Scopa bright red with only apical segment (or sometimes apex of penultimate) black.

Baikal University Station, Aug., type; Baikal Railway Station, Aug. 4 (*Cockerell*). Four specimens.

This is closer to true *M. lapponica*, though the tarsi have only the claw-joint red.

Named after Kurbat Iwanow, who reached Lake Baikal in 1643.

Megachile pilicruriformis, sp. n.

♀.—Size and form of *M. baicalica*, but certainly distinct, the clypeus being shining, sparsely punctured on disc, sides of face with pale ochreous hair, vertex with pure black; abdominal bands pale reddish. The last tergite in lateral profile is slightly concave, quite without outstanding hairs. Hind basitarsus fairly broad. Spurs red; middle tarsi covered on outer side with pale reddish hair; hair on inner side of tarsi bright copper-red. Scutellum glistening, obtusely subconical in middle.

Ust-Balei, July (*Cockerell*).

Very close to *M. pilicrus*, Mor., but clypeus much more sparsely punctured in middle, and not emarginate at end. Also the hind trochanters and femora are not specially hairy beneath.

Megachile epovæ, sp. n.

♀.—Another species with the size and aspect of *M. baicalica*, but certainly distinct by the shining clypeus, with well-separated large punctures; hair of face fulvous, of vertex and disc of mesothorax black; light hair of thorax fulvous, pallid below; first two abdominal tergites with fulvous hair above, the others with black; hair-bands, only subventral on fifth segment, on the others very broadly interrupted, narrow, dense, and white; last tergite in lateral view concave, without erect hair; ventral scopa red, black on last two segments; hind basitarsi somewhat broadened; spurs red. The scutellum is dullish, rough and rounded, not subconical.

Baikal University Station, Aug. (*Cockerell*).

Named after Miss N. A. Epoff, botanist working at the station, who assisted me in identifying the flora.

Megachile rubtzovi, sp. n.

♀.—Like the last, and at first considered identical with it, but last tergite with conspicuous outstanding hair; sides of face, cheeks, pleura, and sides of metathorax with white hair; first two abdominal segments with white hair. The clypeus is shining, with well-separated punctures; ventral scopa very bright red, black on last two segments; narrow marginal hair-bands of abdomen very white.

Ust-Balei, July, type (*Cockerell*); Irkutsk, July (*W. P. Cockerell*).

This appears to be conspecific with, or closely allied to, a species determined by Friese as *M. lapponica*, Thoms., from Innsbruck, though the latter is much smaller and the abdominal bands are not clear white. However, in the polished clypeus with well-separated punctures and the last two segments of scopa black, this departs from true *M. lapponica* and cannot well be that species. Named after Mr. Ivan Rubtsoff, working at the Baikal Station on the planarians of the Lake.

Megachile korotnevi, sp. n.

♀.—Length about 13 mm.

Robust, black, including antennæ, mandibles, and tegulæ; hair of head and thorax abundant, deep brownish fulvous on face and thoracic dorsum, not at all mixed with black on thorax, but black on vertex; head broad; mandibles quadridentate; clypeus moderately convex, very densely rugoso-punctate, with a smooth median line; supraclypeal area shining, sparsely punctured in middle; vertex with large, rather close punctures; cheeks broad, finely rugulose, covered with long fulvous hair; mesothorax closely punctured, shining between the punctures on disc; scutellum evenly rounded, densely punctured all over; area of metathorax dull, with the apical margin shining; pleura with pale fulvous hair. Wings dilute brownish, nervures black. Hair on inner side of tarsi, and inner side of middle tibiæ, bright red; middle tarsi broad, with dense red hair on outer side; hind basitarsi much broadened. Abdomen shining, first two tergites and base of third with long fulvous hair; beyond the hair is short and black, with narrow white hair-bands on 3 to 5, failing in middle of 3; last tergite somewhat concave in lateral profile, with long black hair; ventral scopa very bright red, black on last two segments. Recurrent nervures about equally distant from ends of second cubital cell.

Baikal University Station, Aug. (*Cockerell*); Irkutsk, July (*W. P. Cockerell*). The first is the type-locality.

Extremely like *M. versicolor*, Sm., but that lacks the conspicuous outstanding hair on last tergite. It is smaller than *M. lagopoda*, L., which has the ventral scopa all red. *M. kashmirensis*, Friese, has a much longer face and longer mandibles. *M. nursai*, Friese (Simla), has red tegulæ and red hair on vertex. The name given recalls the famous Baikal Expedition of 1900–1902.

Megachile simlaensis, Cameron.

♀.—Disc of thorax with thick black hair; hair of face creamy white, of cheeks, pleura, and basal abdominal tergites dull white; clypeus rugose, with no smooth median line; first recurrent nervure twice as far from base of second cubital cell as second from apex.

Baikal University Station, Aug. (*W. P. Cockerell*).

This looks like a distinct species, but is perhaps a variety of the last. There are two other specimens from the same place, one exactly like the type, but the other with fulvous hair in place of white, but black hair on disc of thorax. In the latter, the second recurrent is not so near end of second cubital cell. If the two forms are really different species, perhaps the last-mentioned specimen should go with *M. korotnevi*. I am unable to separate this from *M. simlaensis*, from Simla, on comparison with two Cameron types in the British Museum. The smooth line on the clypeus may be present or absent.

Megachile scheviakovi, sp. n.

♀.—Aspect entirely that of *M. simlaensis*, but hind basitarsi long and narrow, nearly parallel-sided; very little outstanding hair on last tergite; vertex and disc of mesothorax with much black hair. Length about 15 mm. Mandibles broad, quadridentate; clypeus convex, highly polished, with well-separated strong punctures; mandibles, antennæ, and tegulæ black; vertex shining, not densely punctured; cheeks broadly rounded, shining; pale hair of head and thorax white. Mesothorax glistening, rather closely punctured; scutellum densely punctured, covered with long hair, which is blackish anteriorly; area of metathorax short, with a sericeous surface, a deep median pit. Wings brownish, nervures dark; first recurrent ending distant from intercubitus a distance about equal to half length of latter; second recurrent going near to end of second cubital cell. Spurs red; hair on inner side of hind basitarsi pale red; abdomen shining, first two segments with greyish-white hair, the others with short black hair; segments 3 to 5 with short white fringes at sides, that on 5 more complete, but all rather inconspicuous; last tergite nearly straight in lateral profile, with very little outstanding hair except at sides; ventral scopa light red, black on last two segments.

Irkutsk, Siberia, Aug. 20, in Dr. Schewiakoff's garden (*W. P. Cockerell*).

The ventral scopa is much paler than in the last, and there is much less outstanding hair on the last tergite. Also, the sculpture of the clypeus is quite different, so, in spite of the very great resemblance, I can only regard them as distinct species. It is larger than *M. versicolor*, Sm., with the cheeks broader and more swollen. It is named after the distinguished zoologist in whose garden it was taken. After writing this, I found in the British Museum a specimen of this species labelled "Angara." It has been in the Museum since 1871.

The next species is similar in general aspect to the three last, but conspicuously smaller and more hoary.

Megachile dybowskii, sp. n.

♀.—Length about 12 mm.

Black, including mandibles, antennæ, and tegulæ, except that the produced apex of mandibles is deep red; hair long and abundant, dull white, very faintly creamy on thorax above, and tinged with dark brown on vertex; mandibles quadridentate; clypeus densely punctured, with a broad, median, shining, sparsely punctured band; cheeks broad; mesothorax dullish, closely punctured, the disc posteriorly polished, with well-separated punctures; scutellum ordinary, not enlarged. Wings clear, very faintly brownish, stigma reddish, nervures fuscous. Legs ordinary, middle basitarsi with dense pale yellowish hair on outer side, middle joints of these tarsi very broad; hind basitarsi moderately broadened, hair on their inner face very pale reddish. Abdomen highly polished, hoary, with long but not dense erect dull white hair, black on fifth segment and partly on fourth (long and all pale on first three); segments 3 to 5 with vestiges of thin bands, hardly apparent; last tergite with some oblique dark hairs; ventral scopa bright orange, white at base, a few dark hairs at apex, or last segment with mainly dark hair. In the type, the area of metathorax is dull, without a median pit; in the other it is moderately shining, with a deep pit. In the type, the second recurrent nervure is considerably nearer end of second cubital cell than first recurrent is to intercubitus; in the other, the distances are about equal.

Baikal Railway Station, Aug. 4 (type) and July 30 (*Cockerell*).

Allied to *M. centuncularis*, L., and similar in aspect, but the mandibles are much longer, red at end, the abdominal tergites much smoother, etc. It runs to *M. centuncularis* in Friese's table. Named after the brothers Dybowski, famous for their researches on the Baikal fauna.

The following key will facilitate the separation of the above *Megachile*:—

- | | |
|-------------------------------------------------------------------------------|-------------------------------|
| Males | 1. |
| Females | 4. |
| 1. Anterior tarsi black, simple | <i>ligniseca</i> , Kirby. |
| Anterior tarsi yellow | 2. |
| 2. Large broad species, of <i>M. latimanus</i> style .. | <i>baleina</i> , Ckll. |
| Smaller, ordinary-sized species | 3. |
| 3. Anterior tarsi broadly dilated | <i>willughbiella</i> , Kirby. |
| Anterior tarsi not dilated | <i>angarensis</i> , Ckll. |
| 4. Ventral scopa white; hair of thorax red above .. | <i>kychtacensis</i> , Ckll. |
| Ventral scopa red, or red and black, or yellow. | 5. |
| 5. Hair of thorax above white; abdomen without bands; ventral scopa red | <i>dybowskii</i> , Ckll. |
| Hair of thorax above fulvous or red, not black or dark brown | 6. |

- Hair of thorax above at least partly black or dark brown 10.
6. Ventral scopa black, red at base *angarensis*, Ckll.
- Ventral scopa with less black, if any 7.
7. Last tergite without outstanding hairs; vertex with fulvous hair; large species *baleina*, Ckll.
- Last tergite with outstanding hair 8.
8. Only sides of vertex with dark hair; ventral scopa yellow, black at tip; broad species *maackii*, Rad.
- Middle of vertex with dark or black hair 9.
9. Hair of apical half of abdomen long and shaggy; hair of thorax above lively fulvous, contrasting with white on pleura [Ckll. *circumcincta lutescens*,
- Hair of apical half of abdomen not long; hair of thorax above not contrasting with pleura; ventral scopa with last two segments all black *korotnevi*, Ckll.
10. Ventral scopa bright red, black on last two segments 11.
- Ventral scopa red, black only on last segment 15.
11. Smaller, length 10.5-11 mm.; hind basitarsi not broad 12.
- Larger and more robust (see descriptions) 14.
12. Clypeus sparsely punctured 13.
- Clypeus densely punctured *lapponica borealica*, Ckll.
13. Last tergites without erect hair; light hair of thorax fulvous *epovæ*, Ckll.
- Last tergite with conspicuous outstanding hair; pleura and sides of metathorax with white hair *rudtzevi*, Ckll.
14. Hind basitarsus narrow *scheviakovi*, Ckll.
- Hind basitarsus broad *simlaensis*, Cameron.
15. Larger and more robust (see description) *willughbiella*, Kirby.
- Less robust, style of *M. lapponica* 16.
16. Clypeus shining, not densely punctured *pilicruriformis*, Ckll.
- Clypeus densely punctured *lapponica kurbati*, Ckll.

Nomia monstrosa, Costa.

Females abundant at Smolenschina in August.

Andrena thoracica, Fabricius.

Smolenschina, Aug. 17 and 21, 8 ♀, 1 ♂.

The wings are dark, the tegulae also dark. According to the colour of the wings, this should be *A. assimilis*, Rad., but the latter, as represented in the British Museum, is very distinct by the closely and finely punctured abdomen. It also has the wings variable in colour. Some *A. thoracica* (as one from Burgos) have clear fulvous tegulae, but others have them dark as in the Siberian form. *A. thoracica* from Tientsin has dark wings.

Andrena sibirica, Morawitz.

I did not obtain this species, but saw one from Irkutsk in the museum of the Russian Academy. It is rather large; abdomen shining, strongly punctured, with three broadly interrupted pure

white bands; apex with fulvous hair; metathorax above rugose (but not a *Trachandrena*), strongly convex; stigma pale fulvous with red margin; thorax above with fox-red hair. In another specimen (from Oshatjean) the end of the abdomen is duller, and there is dense bright red hair overlapping base of metathorax. This overlapping hair appears to have been denuded from the Irkutsk specimen.

Various species of *Andrene*, *Halictus*, *Colletes*, *Sphécodes*, and *Hylæus* must await examination later.

The Angara and Amoor *Megachile* in the British Mussum were "purchased of Mr. Higgins," but the name of the collector is not stated.

XLIV.—*Helicoid Snails from Turkestan*.

By T. D. A. COCKERELL, University of Colorado.

WHEN I was recently at Tashkent, Professor N. A. Keiser of the Middle Asiatic University told me about an expedition he made with fourteen of his students to Lake Issik-kul, and showed me some of the materials obtained. He had a wonderfully variable series of *Limnæa auricularia* from the lake, such as are figured by Alois Weber in his account of Merzbacher's collections. I was, however, especially interested in a series of land-shells, and he kindly placed these in my hands for study. Comparing them with the series in the British Museum (Natural History), and with the accounts in the literature, I was able to determine them without much difficulty. One species in the Museum and one in the Keiser collection appear to be new. The Enidæ I have not seriously studied; no Clausiliidæ were found, and they seem to be absent from the region.

Parvatella sogdiana, von Martens.

Immature specimens referred here are from the vicinity of Tashkent (*R. Kirianova*). They were collected with *Helicella candaharica*.

Parvatella issikensis, sp. n.

Shell greenish-horn colour, shining, moderately translucent, with irregular growth-lines, and close-set plicæ below suture; no spiral lines (examined with microscope); suture (upper edge of bounding whorl) whitened; spire moderate, obtuse; last whorl ample, aperture broad, sublunate, but not expanded laterally; umbilicus closed; columella reflected. Whorls 5.

Diam. max. 21, min. 17·5, alt. 12·4, aperture alt. 9·2, lat. 11·2 mm.

Near Issik-kul, three in British Museum, determined as *P. sogdiana* by Rolle.

This is certainly not *P. sogdiana*, being rounder and less flattened, with the aperture much less excised by the penultimate whorl. Von Martens had *P. sogdiana* from Sarafschan, Ferghana, and the region near Tashkent. Godwin-Austen (Moll. India, vol. ii.) had it from Samarkand, and gave an account of the anatomy. Another species, *P. clessini* (Westerlund), is in the Museum from near Issik-kul; it is much smaller and flatter. I examined the types of *P. coeligena* (Gude) in the Museum; this is very near to *P. sogdiana*, 12 mm. diam., not so flat as *P. clessini*, though of similar aspect. *P. schmidtii*, Brancsik, is not unlike *P. issikensis*, but easily separated by the laterally expanded aperture (aperture alt. 12-13, lat. 15 mm.); the figure shows a brown shell. It occurs under stones in dry regions of Eastern Turcomania, in the region between Merv and the Oxus River. *P. korshinskii* (Westerlund) is said to be opaque or scarcely shining, with fine dense spiral lines. Perhaps it belongs to another genus, as surely does *Macrochlamys turanica*, v. Martens. The Indian species of *Parvatella* are larger (30 mm. diam.), but differ in shape as do the Turkestan ones. Thus *P. altivaga* (Theob.) is of the *P. sogdiana* type; *P. austeniana* (Nevill) resembles *P. issikensis*. In the account of the Merzbacher collection there is a description of *Macrochlamys amdoana*, Mlldff., from Kysil-su, etc. It is a very thin depressed shell—diameter 13.5, alt. 6 mm.; it is not so depressed as *P. clessini*.

Helicella candaharica, Hutton.

Described from Kandahar, Afghanistan, nearly 700 miles from Tashkent. The figure given by Hanley and Theobald, Conch. Indica, pl. cxxxi., agrees excellently with those I collected at Kujluk, near Tashkent. There is also a long series in the British Museum. At Tashkent I found it on spiny bushes in an excessively arid place, many of the shells belonging to a white, bandless variety. Professor Keiser obtained brown specimens, apparently stained, in the mountains between Choolschekent and Chumsan, some 70 kilom. from Tashkent. In Turkestan this has always gone as *H. derbentina*, Andre, but typically that species (occurring in the Caucasus, Crimea, and Asia Minor) is a broader shell, as specimens in the Museum, as well as published figures, show. *H. derbentina* is said to be very variable, with five distinct races, and it may be that the Turkestan shells represent a race of that species, though I think they are certainly *H. candaharica*.

Eulota duplocincta (von Martens).

This very characteristic shell was found in some quantity on trees by the Agricultural School near Issik-kul. Occasional specimens (mut. *cornea*, nov.) are bandless, reddish-horn, whitish beneath. This lot of snails, obtained by Professor Keiser, also

includes many *Cuthaica phæozona*, v. Mts., and a couple of immature *C. plectotropis*, v. Mts. *E. paricincta*, v. Mts., a related but quite distinct species, also from the Issik-kul region. It is not in Professor Keiser's collection, but there is a good series in the British Museum.

Cuthaica phæozona (von Martens).

The series obtained by Professor Keiser, as mentioned above, is very variable, and includes not only shells similar to von Martens's type, but also a large form with elevated spire (f. *grandis*, nov.—max. diam. 19–20 mm., alt. 16–16·5 mm.). Alois Weber (1913) discusses the local variation of this species, and shows that in some places the shells are small (diam. 13 mm.), but, although the large variety is locally distributed, it cannot well be considered a distinct subspecies, since it is accompanied by smaller, typical, shells. In the British Museum are two examples of another variety (f. *lauta*, nov.), white without bands—max. diam. 15–16, alt. 10·5–12 mm. It is also from near Issik-kul.

Cuthaica keiseri, sp. n.

Shell broadly rounded, the spire obtuse, moderately elevated, the last whorl broad and deep, rounded, not at all angulate; aperture approximately circular, except for the excision by penultimate whorl, which is broad and not very deep; lip thickened, white; columella somewhat reflected; umbilicus broad and deep, but not nearly so broad as in *C. fedtschenkoi*; last whorl swollen above at aperture; shell whitish, entirely without bands, spire pale reddish, or most of the shell above reddish; surface dull, apex smooth and shining; sculpture rather rough, with irregular growth-lines but no spiral lines.

Diam. max. 14, min. 12, alt. 9; aperture, alt. 6, diam. 6·5; umbilicus diam. 2 mm. Smaller specimens, diam. max. 12–12·5, min. 10·5–11, alt. 7·2–7·5 mm.

Near Issik-kul near River Tamga (*K. Kirianova*). Several specimens, with one *C. fedtschenkoi*, v. Mts.

Very close to *C. semenovi*, von Martens, but distinct by the larger umbilicus. The original *C. semenovi* was a small, compact, subglobose shell with five slender light brown bands. Lindholm comments on *C. hermanni*, Gude, stating that the description and figure indicate no difference from *C. semenovi*. I examined the types of *C. hermanni*; it is a broader shell (max. diam. 13 mm.), without bands, but evidently very closely related. *C. keiseri* appears at first sight exactly like *C. hermanni*, but it is constantly distinct by the larger umbilicus. It is also very like *C. semenovi depressa*, Mouss., but the aperture is broader, less lunate. In the mountains near the River Keckelick, in the Issik-kul region, a small globose form of *C. semenovi* was found by Miss Kirianova. It has no bands, and the max. diam. is 9–11·4 mm. This is intermediate between true *C. semenovi* and *C. hermanni*, and can well

be referred to var. *globosa*, Weber. All these shells may be known from the *C. rufispira* series by the rounded, not at all angulate, last whorl.

I conclude that the evidence indicates that *C. semenovi*, *hermanni*, *depressa*, and *globosa* are races of a single species, but I think *C. keiseri* is distinct, though very nearly allied.

Cathaica rubens, var. *concolor*, von Martens.

Several from Semiretschye, near Togus-Torau (*N. Keiser*).

This species also runs into numerous local races, some of which may eventually be separated as species.

Cathaica fedtschenkoi, von Martens.

Many from near R. Keakelick, Issik-kul region (*K. Kviranova*).

This is a very characteristic shell. I am quite unable to separate *C. sturanyi*, Rolle, as represented by authentic specimens in the British Museum, except that it is horn-colour above, instead of white. It may represent a local race. *C. sturanyana*, Kobelt, 1893, is also closely related, but larger and more shining, and no doubt distinct. *C. perlucens*, Rosen, is not unlike *C. sturanyi*, but umbilicus narrower and last whorl more expanded; apex shining (dull in *C. sturanyi*); max. diam. 17.3 mm. It comes from the Bokhara country, and is certainly distinct from the immediate alliance of *C. fedtschenkoi*.

Cathaica rufispira, von Martens.

Another variable species, apparently running into local races. *C. retteri*, Rosen, is certainly this species; I find in the Museum *C. retteri*, var. *subglobosa*, Rosen, very pale horn, with a faint pale peripheral band, dull and striate above—max. diam. 14, alt. 8.5 mm. There are also *C. rufispira* varieties called *sowarkandensis*, Rosen, and *fuscior*, Rosen; the former larger and paler (max. diam. 13 mm.), the latter smaller and darker (max. diam. 10.5 mm.).

The reference of all these shells to *Cathaica* may be subject to revision, but I am not convinced that the subgenera of Dr. A. Andreae (1903), based on shell-characters, are perfectly natural. The sharply keeled forms (*Pseudiberus*, Ancy), as represented by *C. plectotropis*, v. Mts., have a peculiar sculpture, and may be related to the non-keeled *C. fasciola*. Drap., of China. Andreae makes *Pseuditerus* arise from the vicinity of *Xerocathaica* (represented in our series by *C. fedtschenkoi*), but I cannot see that there is any affinity.

Turkestan possesses a number of quite distinct Helicoid stocks, most of which were well set forth by von Martens in Fedtschenko long ago. Most of these are subject to local diversification, like the snails of other arid regions, and probably (as in the case of *Oreohelix*, *Helicella*, etc.) numerous closely related species must be recognized. These will be best understood when collected in

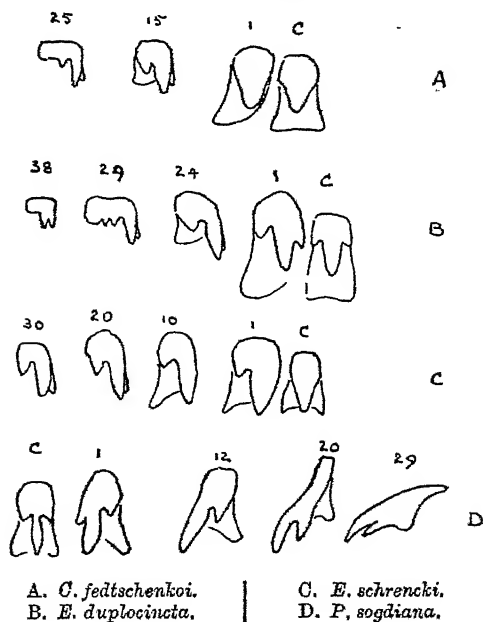
quantity, with careful attention to distribution, and especially when dissected.

The South European fauna invades Turkestan in modified or unmodified species, especially in the case of mobile animals such as insects. In the Issik-kul region, however, there is a very distinct snail faunule, which does not occur in the Tashkent-Samarkand country (now called Uobekistan). One of its most characteristic members, *C. plectotropis*, is recorded by Ancey as going about 300 miles south of Issik-kul to Karghalik.

In Middle Siberia, at Archan and on the shore of Lake Baikal, I found only one large helicoid, the *Eulota schrencki* (Middendorff). Von Martens, when describing *C. phæozona*, compared it with *E. schrencki*, but, although the shells are superficially similar, they are certainly not closely allied. *E. schrencki* is of the *E. fruticum* alliance, a strictly palæarctic type; *C. phæozona* probably has its nearest allies in the Chinese region.

Since the above was written, Col. A. J. Peile has very kindly examined the radulæ of several of the snails, and has supplied the figures now given. He also adds the following comment:—

Parvatella sogdiana (fig. D). Jaw of the usual Zonitoid form, striate from end to end, and with median projection.



A. *C. fedtschenkoi*.

B. *E. duplocincta*.

C. *E. schrencki*.

D. *P. sogdiana*.

Cathaica fedtschenkoi (fig. A). The specimen was not well preserved, but the jaw appeared to be a simple curved structure, with no cross-ribbing.

Eulota duplocincta (fig. B), also poorly preserved. Jaw with five strong even ribs, two on one side of the centre and three on the other.

Eulota schrencki (fig. C). Region of Lake Baikal, Siberia. Jaw has three ribs; in one specimen two of them are abnormal, coalesced into one broad one. In each specimen was found a dart, 3.2 and 3.6 mm. long, from shells 16 and 18 mm. diameter. The dart is a simple slightly curved structure, with slightly swollen base, circular in section, and no ribs or flanges.

The tooth-counts are as follows.—

C. fedtschenkoi, 30. 1. 30, ectocone first appearing at no. 9.

E. duplocincta, 40. 1. 40.

E. schrencki, 34. 1. 34.

P. sogdiana, 35. 1. 35; tooth no. 29 is sketched in profile.

The radula of *C. fedtschenkoi* reminded Col. Peile somewhat of that of *Eulota gerlachi*; the latter has the jaw with weak cross-ribbing over its whole width.

From the shell-characters and radula it seems probable that *E. duplocincta* should form the type of a new subgenus, but I am not prepared to define it at present. The strong lateral points on the first lateral tooth are very distinctive, and separate the species at once from *E. fruticum*, the type of *Eulota*, and from such species as *E. similis*.

XLV.—*Movements in Vorticella.*

By DOUGLAS M. REID, F.L.S.

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1. STALK MOVEMENT.

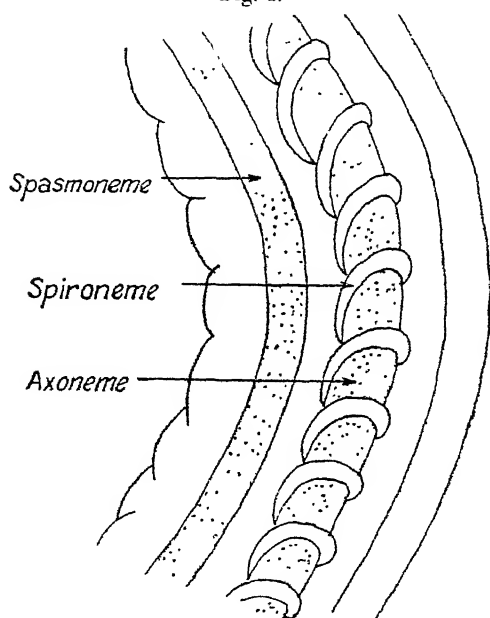
The means of contraction of the stalk of *Vorticella* has been discussed by various authorities since the year 1858, when the process was described by Claparède and Lachmann in their 'Studies of Infusorians and Rhizopods' (1). From that date to the present time there have been various, but not very satisfactory, solutions offered.

The anatomy of the stalk was most elaborately described for the first time by Entz (2) in 1891. His description proved it to be a very complex and highly specialised organ. According to him the stalk is enclosed in a sheath of ectoplasm continuous with that of the head. Inside this sheath

Entz describes three distinct bands, the first of which is a bundle of contractile tissue extending from the distal end of the stalk into the head, where it breaks up into central myonemes. This band he named the Spasmoneme (see fig. 1). The second structure is a central pillar, the Axoneme, round which is coiled the third structure, the Spironeme. The axoneme, with its adhering spironeme, is said to pass along the whole length of the stalk, but does not appear to enter the head.

The spasmoneme was believed by all to be the seat of

Fig. 1.



The stalk of *Vorticella* (after Entz).

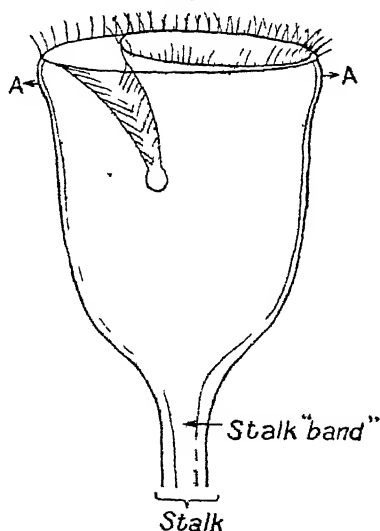
contraction, but the function of axoneme and spironeme (if they exist) has never been settled. Entz himself thought that the spironeme when relaxed becomes extended—that is to say, it acts in a manner diametrically opposed to that of the spasmoneme. To the axoneme he attributed a nervous function, but how this function was applied he does not make clear.

Even the method of contraction of the spasmoneme was fought over by two schools of thought. One school, composed of Claparède and Lachmann (1), Bütschli (3), and

Stein (4), averring that the contractions were caused by muscular action; while their opponents, Entz (2), Cohn (5), Metchnikoff (6), and Schaaffhausen (7), believed the spasmoneme to be composed of elastic myonemes, which consequently tended to contract at all times, but that this tendency was overcome by the muscular efforts of the spironeme. The later protozoologists, such as Minchin (8) and Calkins (9), do not throw any further light on the subject, but simply cite the case as it is outlined above.

On the other hand, I, like Hartog (10), have been quite unable to see more than one band in any vorticellid stalk. This band must correspond physiologically to the spasmoneme of Entz (fig. 2).

Fig. 2.



A ← → A, region of circular Myonemes.

When a living *Vorticella* is examined under the microscope, a difference is at once noticeable between the rates of contraction and extension, for, whereas the former is accomplished with great rapidity, the latter is a comparatively slow process. The difference in the rates of movement is, in itself, sufficient to indicate that the two actions are carried out by different means.

Now, if the stalk contractions are left for the moment and an examination made of the ciliary action in the head, quite a different solution presents itself. When the gullet cilia and undulating membrane are in the active state,

a current of water is being driven downwards into the protoplasm of the organism. This pressure necessarily, since the protoplasm is a sol whose continuous phase is water (11), will be transmitted to all parts of the organism, the stalk included. If, as is possible, the stalk is a cylinder composed of protoplasm similar to that of the head, any pressure applied to the end of it when it is in the coiled position will cause it to tend to assume a straight form. This is a physical principle made use of in the Bourdon Pressure-gauge (12).

Thus there is (a) a bundle of elastic myonemes—the spasmoneme—tending always to pull the stalk into a spiral form (to demonstrate this place a short piece of very narrow bore rubber tubing inside a piece of much wider bore join the respective ends by tying, and it will be found that the contraction of the inner tube throws the outer into the form of a spiral); but this is overcome by (b) increase of turgidity of the stalk due to the pressure caused by the gullet cilia and undulating membrane.

It must be understood that the coronal cilia have nothing whatever to do with the extension of the organism, for it has been observed that these cilia do not commence to vibrate at least until full extension is obtained, while they may remain inactive for a considerable time after full extension.

The spasmoneme may be considered to be composed of elastic, not muscular, fibrils, for, although there is no direct proof to support this statement, the fact that a protozoon is being discussed tends to make one seek the simplest form of mechanism. Thus elasticity acting in opposition to turgidity is a much simpler hypothesis than is the opposing action of two sets of muscles.

The turgidity theory is further borne out by the fact that, when the cilia become active, the stalk straightens out and continues to remain straight so long as ciliary action continues, but directly this activity ceases sudden retraction takes place.

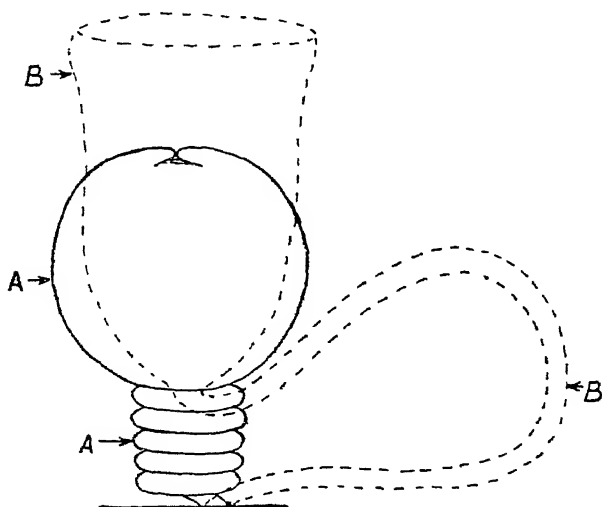
This action may be demonstrated more clearly by taking a *Vorticella* and placing it so that the head is immovably fixed at a point close to the distal attachment of the stalk (see fig. 3).

In the quiescent state the stalk will form the usual close spiral, but when the cilia become active the head of course remains where it is, while the stalk extends gradually until it has assumed the straightest possible form.

Another important fact which seems to bear out the

theory of the movement being due to turgidity and elasticity is the behaviour of the stalk when the head is removed. If the decapitation is performed while the organism is in the extended state, the stalk immediately assumes the spiral form. This is easily understood when one considers that removal of the head implies cessation of ciliary action and consequent removal of pressure from the stalk.

Fig. 3.

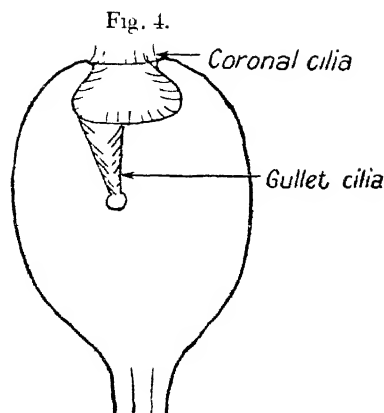


A. Position during retraction.
B. Position during extension.

2. MOVEMENTS OF THE CIRCULAR MYONEMES.

The circular myonemes form a band which controls the inversion and eversion of the coronal cilia (see fig. 2). This band must also be considered to be composed of elastic and not muscle-fibres. In this case also the pressure generated by the gullet apparatus will account for the action of these fibrils, as in the case of those of the stalk.

Now frequently, when a *Vorticella* has become extended, it may remain for a considerable time with the coronal cilia inverted (see fig. 4). While the coronal cilia are in this position the gullet cilia will be seen to be vibrating at a much reduced rate. However, directly the latter again begin to vibrate at their normal speed, the coronal cilia become everted. This seems to point to the fact that it is a case of pressure overcoming the action of the elastic circular myonemes.



Partial eversion of the coronal cilia.

3. CONCLUSION.

In conclusion, it may be said that this paper attempts to prove that the contraction and extension of the stalk of *Vorticella* is not due to the complex action of two opposing bundles of muscle-fibres, but to the simpler phenomenon of internal pressure (acting on one end of a coiled tube whose other end is closed) in opposition to coiling due to the action of elastic fibres—a process demonstrated by the action of the Bourdon Pressure-gauge.

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XLVI.—*A Third Species of Dwarf Jerboa*, *Salpingotus thomasi*, sp. n. By B. S. VINOGRADOV.

IN the course of my studies on the collections of the British Museum (Natural History) I found there a specimen of the striking genus *Salpingotus*, which had been transferred from the India Museum under the name of "*Alactaga indica*, Gray." The specimen was collected by Griffith in the years 1839–41, probably in Afghanistan (see below). Though it was not preserved quite satisfactorily, all essential characters of a member of the genus *Salpingotus* are clearly visible. My detailed study enables me to conclude that the present species is more closely allied to *S. crassicauda*, Vinogr., from Gobi-Altai than to *S. kozlovi*, Vinogr., from Central Gobi Desert (N. Alashan); some important distinguishing characters do not permit me, however, to identify the present specimen with either of the other two species, and make it necessary to consider it as a new species of this peculiar genus.

So far only three specimens of *Salpingotus* are known, all in the Zoological Museum of the Russian Academy of Sciences in Petrograd; the discovery of a new species offers some interesting new facts for the arrangement and geographical distribution of this little-known group.

I am very much indebted to Messrs. Oldfield Thomas and M. A. C. Hinton for permission to examine the specimen and to publish the present account of it. I am very pleased to have the opportunity of naming this interesting animal in honour of the former.

In the present specimen the following peculiarities characteristic of the genus *Salpingotus* can be seen. Hind foot with three toes and three separate metatarsals not fused in a single "cannon-bone" (as is clearly seen in the right hind limb of the type-specimen with deteriorated integument on metatarsal bones). The fore part of the zygoma forms a broadened plate sharply contrasting with its thin posterior part. The characteristic process of the zygoma is quite distinct, but feebly developed, as described below. Of the bullæ only some pieces are present, but their structure and the shape of the neighbouring bones enable me to restore the enormously-developed bullæ which occupy a considerable part of the upper surface of the skull and touch each other along the median line. Upper incisors without grooves. Dental formula $p. \frac{1}{0} : m. \frac{3}{3}$. The external ear-conch and hind foot are of the structure typical of *Salpingotus*.

Salpingotus thomasi, sp. n.

Type.—B.M. no. 79. 11. 21. 433. Adult specimen with molar teeth not worn, collected by W. Griffith in the years 1831–41.

Type-locality.—Probably Afghanistan. The specimen was originally in the East India Company's Museum with the label "Afghanistan, W. Griffith." So far as it is possible to learn from Griffith's 'Journal of Travels,' vols. i.–ii., Calcutta, 1847, he travelled and collected in some parts of the Himalayas (Upper Assam and Bhotan) and through India proper.

Diagnosis.—Tail about 105 mm., considerably longer than in *S. crassicauda*, but shorter than in *S. kozlovi*. The tail in its foremost half considerably thickened in connection with the presence of the fat covering on vertebræ, as in *S. crassicauda* *. The tail covered with very short hairs, which are only a little longer on the tip. Hind foot somewhat longer than in *S. crassicauda*.

The most important character of *S. thomasi* as compared with two other species is the structure of the zygoma: the process rising from the middle of the zygomatic arch is much reduced in *S. thomasi*, and forms only a small angular projection not elongated and not bent posteriorly as in *S. crassicauda*. The broadened anterior half of the zygoma is not separated so sharply from its posterior thin part—beginning from the tip of the above-mentioned process it grows gradually thinner.

The structure of the molar teeth is essentially as in the two other species, but the grinding-surfaces of m^1 and m^2 in the type-specimen are quite unworn, and therefore are furnished with four evident tubercles somewhat similar to those in *Sicista*.

The colour of *S. thomasi* is not described here because the type-specimen, collected nearly ninety years ago, has lost its natural colour.

Measurements.—The unsatisfactory condition of the type-specimen allowed only a few measurements to be taken. The external measurements are made on the dried skin, but the length of the tail and hind foot seem to be fairly correct, because the tail was dried with its vertebræ and the hind feet with their bones complete.

* This thickening is not very considerable in the type-specimen, but it is covered with dried and wrinkled skin impregnated with modified fat. It is quite evident that the fresh specimen had practically the same structure of the tail as in *S. crassicauda*.

Head and body 57 mm. (?) ; tail 105 ; hind foot 23·3 ; ear 9 (?) ; interorbital constriction 4·5 ; nasalia 8·0 ; maxillary tooth-row 3·0.

Remarks.—The described structure of the zygoma in *S. thomasi* inclines me to consider this species somewhat less specialised than *S. crassicauda* and *S. kozlovi* ; the skull of *S. thomasi* has therefore more in common with that of the five-toed dwarf jerboa *Cardiocranius* than both the other species of *Salpingotus*.

The few known data on the geographical distribution of the genus *Salpingotus* make me regard these jerboas as representatives of the fauna of Mongolian deserts. The occurrence of a representative of this genus in Afghanistan is therefore rather unexpected, the fauna of this country consisting of quite different elements. New explorations in Afghanistan and Southern Tibet will give more exact data on the geographical distribution of this interesting animal.

XLVII.—*On a Racial Form of Aspidiotus lenticularis, Lindgr., with some Remarks upon the Leonardi Classification of the Aspidioti.* By E. ERNEST GREEN, F.E.S., F.Z.S.

Aspidiotus lenticularis maroccanus, var. nov. (Fig. b.)

Differing from the type-form in the complete absence (or reduction to the vanishing-point) of the normal groups of perivulvar pores.

On *Olea europæa*, Morocco (coll. A. Balachowsky).

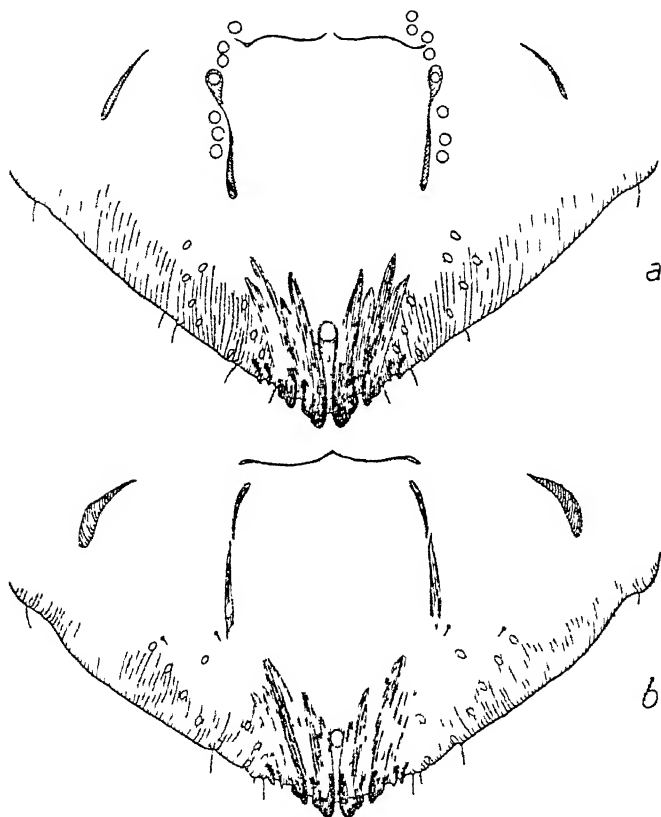
The absence of perivulvar pores, in conjunction with the other characters, at first led me to regard this insect as a species of *Targionia*, although its resemblance (otherwise) to Lindinger's species had been noticed. But further study revealed the interesting fact that, in a small percentage of examples, an occasional isolated pore (still more rarely two pores) occurred in places corresponding with the positions of the normal groups. This discovery, together with the fact that it infests the same host-plant, convinces me that this insect is merely a racial form of *lenticularis* (fig. a).

The typical form was described by Lindinger* from examples taken on *Olea europæa* and *Euphorbia wulfeni*, in Dalmatia. It presents four groups of perivulvar pores, with

* Lindinger, 'Die Schildlaus,' pp. 149, 230 (1912).

an average number of three and four pores in the upper and lower groups respectively.

The occurrence of these two forms leads to a consideration of the merits of the classification propounded by the late Professor Gustavo Leonardi. His arrangement has been very generally adopted for the subdivision of the once



a. Pygidium of *Aspidiotus lenticularis*, Lindgr. $\times 250$.

b. Ditto of *Aspidiotus lenticularis*, var. *maroccanus*, Green. $\times 250$.

cumbersome genus *Aspidiotus*. But it is probable that many students of Coccidæ must have experienced difficulties in the rigid acceptance of this system of classification. It may be compared with the old Linnæan system of botanical classification as opposed to the present-day natural system. It suffers from a certain artificiality—in some cases bringing

together species that would, in a more natural arrangement, be widely separated; in others (as in the instance noticed above) divorcing, under separate genera, species that are closely related, or even racial forms of a single species; and, in yet other cases, affording no accommodation for certain species which combine characters allotted by Leonardi to distinct genera. Of this last defect *Aspidiotus lenticularis* itself is a case in point. This species (of which I possess material) has small but distinct groups of perivulvar pores, conspicuous paraphyses, and no apparent squamulæ—a combination of characters that would prevent its inclusion in any of the genera as defined in Leonardi's key. The absence of squamulæ excludes it from *Chrysomphalus*; the presence of perivulvar pores shuts it out from *Turgionia*; while the conjunction of these two characters debars it from finding a resting-place in either *Hemiberlesia* or *Aonidiella*. Nor has it any proper right to a place in *Aspidiotus*—a genus that is characterized by the presence of conspicuous pectinate squamulæ.

A good instance of the separation (by the Leonardi classification) of two closely allied species is to be seen in the case of *Hemiberlesia lataniæ* and *Aspidiotus camelliæ*, the only possible distinction between them being found in the presence or absence of perivulvar pores.

XLVIII.—*The Croton Leafhopper, Cicadella histrio (Fabr.).*
By J. G. MYERS.

CICADA HISTRIO was described by Fabricius (Ent. Syst. iv. p. 34) in 1794 without mention of locality. Stål (Kongl. Svenska Vet.-Akad. Handl. viii. no. 1, Hemiptera Fabriciana, p. 76) in 1869 gave a remarkably good redescription of the type. With this description my abundant series from Cuba agrees exactly. The Cuban specimens correspond also with the type (and only example) in the British Museum of *Tettigonia robusta*, Walk. (List Homopt. p. 777), described in 1851 from an unknown locality. Walker's species is described and figured by Signoret (Ann. Soc. ent. France, (3) ii. p. 10, pl. i. fig. 9), the figure being very poor, though not positively incorrect in markings. Signoret (*op. cit.* (3) i. p. 670) considers *Tettigonia histrio* (Fabr.) as possibly the same as the Indian *T. quadrilineata*, Sign., described on the preceding page and illustrated in pl. xxi. fig. 12, but this figure shows the Indian species to be quite distinct.

The present species stands in the collection of the Estacion Experimental Agronomica, Santiago de las Vegas, Cuba, as "*Cicadella robusta*, Signoret." Osborn (Ann. Ent. Soc. America, xix. p. 340, 1926) has synonymized it with *histrío*, Fabr., without seeing the type, and the same synonymy was indicated by Stål.

It is now certain that *Cicadella histrío* (Fabr.) is a West-Indian species, and that *robusta*, Walk., is synonymous.

C. histrío was especially abundant in February 1925 in the Harvard Botanical Garden, Soledad, Cuba, on "crotons"—*Codiaeum variegatum* (L.), Bl., forms *angustifolium*, Müll., Arg., and *parvifolium*, Müll., Arg.*.

When resting on these strongly reddish plants the leaf-hopper was extremely "protectively coloured" and very difficult to detect even when present in swarms. In flight, on the other hand, the brilliant red abdomen was displayed and the insect became very conspicuous. Its practical disappearance, when it settled on the host-plant, recalls that of numerous other insects under similar conditions.

Odd specimens were swept from *Polygonum acre*, H. B. K., and from *Ginoria americana*, Jacq., growing in a nearly dry ditch, in early March. It was only on *Codiaeum*, however, that it was extremely abundant, and this, though a garden-plant, seemed at Soledad its main host. Dr. G. Salt took one example in the Trinidad mountains (23rd March), and Osborn records it from "a small tree" at Jatibonico. Adults were still numerous at Soledad by the end of June (G. Salt).

I am indebted to Mr. W. E. China, of the British Museum, for help in tracing these references and types.

XLIX.—*A List of New Zealand Heteroptera with the Description of a remarkable Green Aradid representing a new Genus.* By J. G. MYERS and W. E. CHINA.

It is not surprising that the localities from which collections were brought by the earlier explorers and naturalists were sometimes confused. New Zealand has had perhaps more than its share of such mistakes, some of which—as, for instance, that concerning *Turnagra capensis*, Sparr., an endemic Passerine—have been perpetuated in the specific name. The list of recorded New Zealand Heteroptera,

* These and other plants mentioned were kindly determined by Mr. C. A. Weatherby of the Gray Herbarium.

small as it is, contains a number of items which are undoubtedly erroneous—of which one has been unfortunately made the basis of considerable zoo-geographical speculation by Horváth (1926).

The present position of hemipterological study in New Zealand renders a discussion of these and other species both practicable and opportune. At the time of his death Dr. Bergroth had been working on an extensive collection from the Dominion, on which he had published two short papers (1924, 1927). It is hoped that the remaining material will be studied by specialists in the various families concerned. In the meantime, it is essential that the earlier records be cleared up in the light of New Zealand experience and with the aid of types and other material in the British Museum. New Zealand Heteroptera have been previously listed by Hutton (1874, 1898, 1904), by Butler (1874), by Buchanan White (1878–1879), and by Kirkaldy (1909). All these lists were largely compilations. In the present paper it has not been considered necessary to repeat the references, which will be found in the various works cited at the end.

The New Zealand Subregion includes the Kermadecs.

Our list is divided into three sections: (A) those species which are undoubtedly indigenous, (B) those which have been introduced through the agency of man, and (C) those which are either erroneously recorded or strongly need confirmation.

A. INDIGENOUS SPECIES.

Pentatomidæ.

1. *Æchalia consocialis* (Boisd.).

Australia and New Zealand.

2. *Cermatulus nasalis* (Westw.).

Australia and New Zealand.

3. *Zangis amyoti* (White).

Australia and New Zealand.

4. *Dictyotus cænosus* (Westw.).

Australia and New Zealand.

5. *Hypsithocus hudsonæ*, Bergr.

Endemic.

6. *Rhopalinomorpha obscura*, Dall.

Endemic.

7. *Oncacontias vittatus* (Fabr.).

Endemic.

Cydnidæ.

8. *Hahnia australis* (Erichs.).

Oriental and Australian Regions.

9. *Chærocydnus nigrosignatus*, F. B. W.

Endemic.

10. *Pangæus scotti*, Sign.

Not known to us save from the original description. If it really came from New Zealand, then it must be extremely rare.

Aradidæ.

11. *Aradus australis*, Erichs.

Australia, New Zealand, and New Caledonia.

12. *Pseudaradus viridis*, gen. et sp. n.

See Appendix to this paper.

13. *Pseudaradus cinereus*, sp. n.

See Appendix to this paper.

14. *Ctenoneurus hochstetteri* (Mayr).

Endemic.

15. *Aneurus brouni*, F. B. W.

Endemic.

16. *Isodermus planus*, Erichs.

Tasmania and New Zealand. N.Z. examples determined by Dr. E. Bergroth, collected at Waitati, Dec. 4, 1921, by Mr. G. Howes.

Lygæidæ.

17. *Arocatus rusticus*, Stål.

Australia and New Zealand.

18. *Nysius huttoni*, F. B. W.

Endemic.

19. *Nysius clavicornis* (Fabr.).

Endemic.

20. *Nysius anceps*, F. B. W.

Endemic.

21. *Metagerra helmsi* (Reut.).

Endemic.

22. *Metagerra obscura*, F. B. W.

Endemic.

23. *Orthæa nigriceps*, Mayr.

Pacific generally.

24. *Targarema electa*, F. B. W.

Endemic.

25. *Targarema stålî*, F. B. W.

Endemic.

26. *Margareta dominica*, F. B. W.

Endemic.

27. *Taphropeltus putoni*, F. B. W.

Endemic.

Neididæ.

28. *Neides wakefieldi*, F. B. W.

Endemic.

Tingidæ.

29. *Cyperobia carectorum*, Bergr.

Endemic.

Nabidæ.

30. *Nabis saundersi*, F. B. W.

The synonymy of this with the allegedly cosmopolitan *N. capsiformis*, Germ., is doubtful.

31. *Nabis maoricus*, Walk.

Endemic.

32. *Nabis biformis* (Bergr.).

Endemic.

33. *Nabis quadripunctatus* (Bergr.).

Endemic.

34. *Alloxorrhynchus myersi*, Bergr.

Endemic. The only New Zealand Heteropteron which is even remotely Myrmecoid.

Gerridæ.

35. *Halobates sericeus*, Esch.

All tropical oceans, but chiefly the Pacific.

Veliidæ.

36. *Microvelia macgregori*, Kirk.

Endemic.

37. *Microvelia oceanica*, Hale, not Distant.

New Zealand, Australia, Tasmania, and Lord Howe Island. Prof. Esaki states that this species is distinct from the true *M. oceanica*, Dist., from New Caledonia, and he will accordingly rename it in the near future.

Reduviidæ.

38. *Plæaria huttoni* (Scott).

New Zealand and Juan Fernandez.

39. *Plæaria antipodum*, Bergr.

Endemic.

40. *Empicoris rubromaculatus* (Blackb.).

Said to occur in New Zealand, Polynesia, Australia, West Indies, North and South America, and Madeira.

41. *Empicoris aculeatus* (Bergr.).

Endemic.

42. *Empicoris angulipennis* (Bergr.).

Endemic.

43. *Empicoris seorsus* (Bergr.).

Endemic.

Henicocephalidæ.

44. *Henicocephalus maclachlani*, Kirk.

Endemic.

45. *Gamostolus tonnoiri*, Bergr.

Endemic.

Anthocoridæ.

46. *Cardiastethus brounians*, F. B. W.

Endemic.

47. *Cardiastethus consors*, F. B. W.

Endemic.

48. *Cardiastethus poweri*, F. B. W.

Endemic.

Miridæ.

49. *Megaloceræa reuteriana*, F. B. W.

Endemic.

50. *Romna capsoides* (F. B. W.).

Endemic.

51. *Romna scotti* (F. B. W.).

Endemic.

52. *Romna marginicollis* (Reut.).

Endemic. According to Bergroth (*in litt.*, April 6, 1922), Reuter's genus *Oxyphilophora* is synonymous with *Romna*, Kirk. (= *Morna*, F. B. W.).

53. *Romna* sp., F. B. W.

Endemic.

54. *Reuda mayri*, F. B. W.

Endemic.

55. *Lygus maoricus* (Walk.).

Endemic. See Distant (1904).

56. *Lygus plebejus*, Reut.

Endemic.

57. *Calocoris laticinctus* (Walk.).

Endemic. *Capsus ustulatus*, Walk., is a synonym. See Distant (1904).

Saldidæ.

58. *Salda australis*, F. B. W.

Endemic.

59. *Salda butleri*, F. B. W.

Endemic.

60. *Salda lælaps*, F. B. W.

Endemic.

61. *Salda* sp., F. B. W.

Endemic.

Notonectidæ.

62. *Anisops wakefieldi*, F. B. W.

Endemic.

63. *Anisops assimilis*, F. B. W.

Endemic.

Corixidæ.

64. *Arctocorisa arguta* (F. B. W.).

Endemic.

65. *Diaprepocoris zealandiæ*, Hale.

Endemic. The specimen from Launceston, Tasmania, recorded by Hale (*in* Myers, 1926, p. 465), is labelled

"*D. barycephala*, Kirk., syntype" in Kirkaldy's handwriting, but is probably specifically distinct from any of the described species. Miss A. Castle kindly writes that this species (*D. zealandiæ*) has now been found in the stomachs of brown trout (*Salmo fario*, L.) caught in the Styx River, Canterbury, early in 1926.

Peloriidiidæ.

66. *Xenophyes cascus*, Bergr.

Endemic.

B. INTRODUCED FORMS.

Anthocoridæ.

67. *Lyctocoris campestris* (Fabr.).

Cosmopolitan.

Cimicidæ.

68. *Cimex lectularius*, L.

Nearly cosmopolitan, but not known in New Zealand prior to the advent of Europeans.

Miridæ.

69. *Stenotus binotatus* (Fabr.).

Europe.

70. *Calocoris norvegicus*, Gmel.

A common introduced species on grasses, now recorded for the first time. The male genitalia of Canterbury examples collected by Mr. J. W. Campbell were compared with European material.

71. *Eurystylus australis*, Popp.

Australia.

C. DOUBTFUL RECORDS.

Pentatomidæ.

Nezara viridula (L.).

Nearly cosmopolitan. See Myers (1926, p. 498). The

examples recorded by Walker under the name of *Rhaphigaster prasinus*, L., from New Zealand, have been examined in the British Museum and found to be all *Zangis amyoti*, White. There is no evidence that *Nezara* occurs in New Zealand.

Diemenia immarginata (Dall.).

An Australian species, of which Dallas stated that there was an example in the British Museum from New Zealand. No such specimen is now to be found.

Sciocoris helferi, Fieb.

A southern European species. This record from New Zealand has been already doubted by Kirkaldy (1909, p. 24). It is based solely on "Novara" data, which are well known to be open to suspicion.

Calliphara imperialis (Fabr.).

Two specimens in the British Museum said by Walker to be from New Zealand. One of these two examples from the Saunders collection (reg. no. 1865, 13) is still in the Museum, with a New Zealand label, but no collector's name. It is extremely doubtful whether this Queensland species ever occurred in New Zealand.

Scutiphora pedicellata, Kirby.

Australia and New Guinea. Another "Novara" record, already doubted by Kirkaldy (*l. c.* p. 25).

Lygæidæ.

Stalagmostethus pacificus (Boisd.).

Australia and New Caledonia. A specimen is said by Dallas to have been received from Sinclair in New Zealand. This example is not to be found in the collection of the British Museum.

Coreidæ.

Dindymus versicolor, H.-S.

Australia. Kirkaldy records one specimen from New Zealand. Even if this were correct, the species is evidently not established.

Reduviidæ.

Pirates ephippiger (A. White).

Australia. This was described from New Zealand, collected by Dr. Sinclair. As in the case of *Stalagmostethus pacificus* above, we should suggest that he obtained the material in Australia. There is in the British Museum one specimen with a New Zealand label and Sinclair's name.

Nabidæ.

Nabis lineatus, Dahlbom.

Hutton gave no indication that this species was authoritatively determined, and we believe with Kirkaldy that the record is erroneous.

Phymatidæ.

Phymata inconspicua, Scott.*Phymata feredayi*, Scott.

Both these species are known only from the original specimens, said to have been collected by Fereday in New Zealand. Fereday was a well-known early lepidopterist in Canterbury, New Zealand. This region has since been very extensively collected by some of the most energetic entomological field-workers New Zealand has yet had, and it is extremely improbable that such insects as these would have been overlooked.

The types are true Phymatids, and both species come very close to some of the varieties of the common and widespread American *Phymata erosa*, L. There is in the British Museum Collection a *Phymata* from Santarem, Amazonas, which is very close indeed to the *P. feredayi* of Scott, but the male genitalia are different. Without a critical revision of the genus it is therefore not possible to identify these examples with any American species on our present material, but there is no real evidence in Scott's paper (1876) that the specimens came from New Zealand. The insects bear no locality-labels. Scott described a number of Hemiptera from tropical America, whence these three examples might easily have come.

Horváth (1926), in a very interesting paper on the geographical distribution of the Hemiptera, is much exercised to explain the supposed presence of *Phymata* in New Zealand, but believes it to be an indication of a former

Antarctic connection. On this much-disputed question it is noteworthy that Oliver (1925) has succeeded in explaining most of the problems of New Zealand biogeography without the intervention of an actual land-bridge from Antarctica.

Corixidæ.

Diaprepocoris barycephala, Kirk.

This is an Australian species. The New Zealand form has been described as distinct by Hale.

We believe that the twelve species in section (C) of the above catalogue should be expunged from the New Zealand list until further confirmation of their presence in the Dominion is forthcoming.

In view of the large number of New Zealand Heteroptera yet to be described, including a strong representation in the Miridæ, it would be futile to attempt comparisons with other faunas further than those suggested in Myers (1926, pp. 450 *et seqq.*).

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APPENDIX.

A remarkable new Genus and Two new Species of Aradidæ from New Zealand.

PSEUDARADUS, gen. nov.

Ovate, the connexivum moderately dilated, the apical abdominal segments distinctly reflexed. Covered with irregular patches of minute circular concave scales and with scattered irregular tubercles, especially on the head and pronotum.

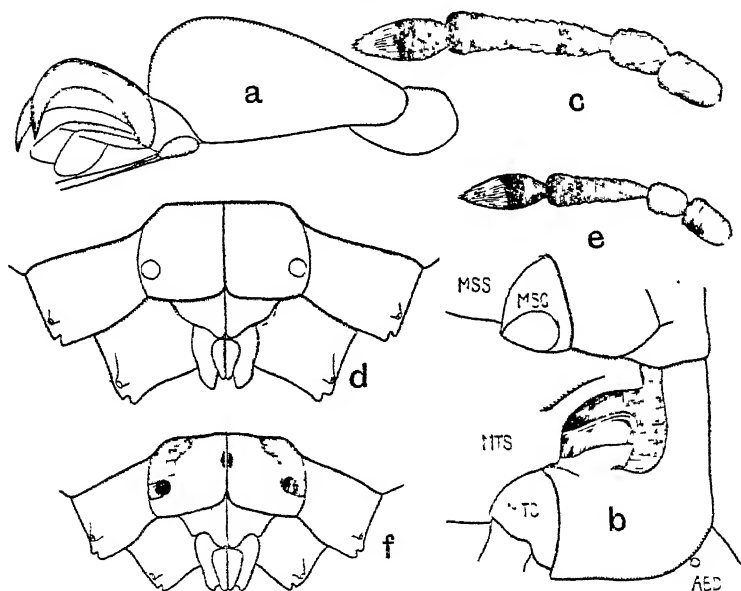
Head slightly exserted, basal margin more or less rounded behind the eyes; tylus well developed, produced anteriorly into a laterally compressed, apically rounded, strongly elevated process armed dorsally with two longitudinal rows of small teeth-like tubercles; lateral antenniferous lobe of head produced into a more or less prominent spine, the lateral margin in front of eyes comparatively straight; vertex with a short longitudinal shallow impression on each side of the middle line; eyes globose, prominent; rostrum extending to middle of the prosternum, basal segment* very short, enclosed between moderately elevated sinuate bucculæ; second segment very short, third longest, extending to anterior margin of prosternum. Antennæ moderately short and incrassate, the basal segment more or less cylindrical, short, not extending to the apex of the tylus, suddenly constricted at base, not gradually narrowed.

Pronotum transverse, lateral margin with posterior half dilated to form an anteriorly-directed lobe, anterior half with a distinct tooth-like process; disc posteriorly moderately elevated, anteriorly depressed, with two more or less obsolete incomplete median carinæ represented by one pair of prominent tubercles placed towards the base, and a much less

* The rostrum in the Aradidæ is four-segmented as stated by Parshley, not three-segmented as stated by Stål, Reuter, etc.

prominent pair near the anterior margin; lateral carinae represented only by a pair of obsolete ridges placed towards the base above the basal angles of the scutellum. Posterior margin broadly but shallowly emarginate. Scutellum longer than broad at base, parallel-sided basally: lateral margins and apex reflexed; disc posteriorly concave, anteriorly elevated in the form of a very obtuse V-shaped transverse ridge, with a more or less conical tubercle at each side.

Fig. 1.



Pseudaradus, gen. nov.—*a*, tarsus showing bristle-like arolia and membranous pseudarolia; *b*, metasternal odoriferous orifice showing well-developed evaporative area; *MSS.*, mesosternum; *MSC.*, mesocoxa; *MTS.*, metasternum; *MTC.*, metacoxa; *ABD.*, abdomen.

P. cinereus, sp. n.—*c*, antenna; *d*, female genital plates.

P. viridis, sp. n.—*e*, antenna; *f*, female genital plates.

Pro-, meso-, and metasterna each with a shallow median groove, the posterior margin of the prosternum with a pair of granulate tubercles placed between the procoxae; metasternal openings of the odoriferous glands large and very distinct, forming broad auriculate structures, provided with well-developed evaporative areas (fig. 1. *b*). Hemelytra complete, a little shorter than the abdomen; corium longer

than scutellum, the veins strongly elevated, especially along apical margin of corium; inner sector well defined, percurrent, outer sector obscure; costal margin at base strongly laminately expanded to form a lateral lobe. Membrane with distinct raised veins forming several basal cells and with the apical half reticulate. Wings well developed. Middle and hind legs widely separated, trochanters more or less fused with the femora, which are moderately incrassate and unarmed; tibiæ about as long as the femora; tarsi two-jointed, very short, with well-developed claws provided with bristle-like arolia and large membranous pseudo-arolia (fig. 1, a).

Abdomen with connexivum broadly dilated; first and second (second and third abdominal sternites) spiracles ventral, third, fourth and fifth dorsal, sixth and seventh ventral but placed very close to the lateral margin.

Genotype, *Pseudaradus viridis*, sp. n.

In general appearance this genus is very similar to *Aradus*, F., from which, however, it may be distinguished by the distinct metasternal openings to the odoriferous glands, by the presence of well-developed tarsal pseudo-arolia, and by the dorsal position of the spiracles of the fourth, fifth, and sixth ventrites. As far as we are aware, the only other genus of the Aradoidea possessing well-defined Pentatomid-like metasternal openings of the odoriferous glands is the genus *Prosympiestus*, Bergr., recorded from Australia and Tasmania, which Bergroth* placed in the Isoderminæ.

So far as is known, the spiracles in the Aradoidea are always either ventral or lateral. In the Aradinæ the first six are ventral and the seventh lateral. In the Dysodiinæ all seven spiracles are ventral except in the genus *Aneurus*, Curt., in which the position is variable. In *A. lævis*, F. (= *A. tuberculatus*, Mjög.), the first, fourth, fifth, sixth, and seventh are lateral and only the second and third ventral, while in *A. avenius*, Duf. (= *A. lævis*, Mjög., nec F.), only the first, sixth, and seventh† spiracles are lateral, the rest being ventral.

In the Isoderminæ all seven are ventral, but all except the first, which is more or less obsolete, are placed very close to and touching the lateral margin. In *Prosympiestus*, Bergr., however, which agrees with *Pseudaradus* in the

* Ent. Tidskrift, xv. p. 117 (1894).

† Unfortunately, the seventh spiracles are not shown in Mjögberg's figures of *A. lævis* and *A. tuberculatus* given on pages 7 and 8, Arkiv för Zool. v. no. 11 (1909).

structure of the "stink"-gland openings, the spiracles are all placed ventrally, well away from the lateral margin.

With regard to the presence of arolia, these structures are usually absent in the Aradoidea, but as has been shown previously* they are present in the Termitaphididae and in the Dysodiid genus *Otenoneurus*, Bergr. *Pseudaradus* may be placed in the subfamily Aradinae on the evidence of the structure of the head, pronotum, scutellum, hemelytra, and trochanters.

Pseudaradus viridis, sp. n. (Fig. 2, b.)

♀.—Pale yellowish green, particularly bright on the pronotal and corial lobes and on the connexivum, the head (except tylus), rostrum (except apex of second and third segments), antennae, pronotum (except the lateral lobes and the posterior disc), basal half of scutellum, veins of corium, and the sternum suffused with brown; eyes, apex of third and middle of fourth antennal segments, median pronotal tubercles, cicatricial arcs of pronotum, basal angles and apical half (except narrow green margins) of scutellum, apical marginal corial vein, meso- and metasterna between and above the acetabula, the margins of the translucent membranous sensory spots of the abdomen, and a large arcuate spot at the lateral basal angle of each lobe of the sixth ventrite black. Genital lobes greenish white, the disc of the abdomen greenish yellow.

Coxae pale brown, trochanters pale yellow; femora brown with the basal third and a subapical annulation pale yellow; tibiae pale yellow with subbasal, median, and apical annulations brown; tarsi and claws brown. Membrane ash-grey, with the apical half and the veins infuscate.

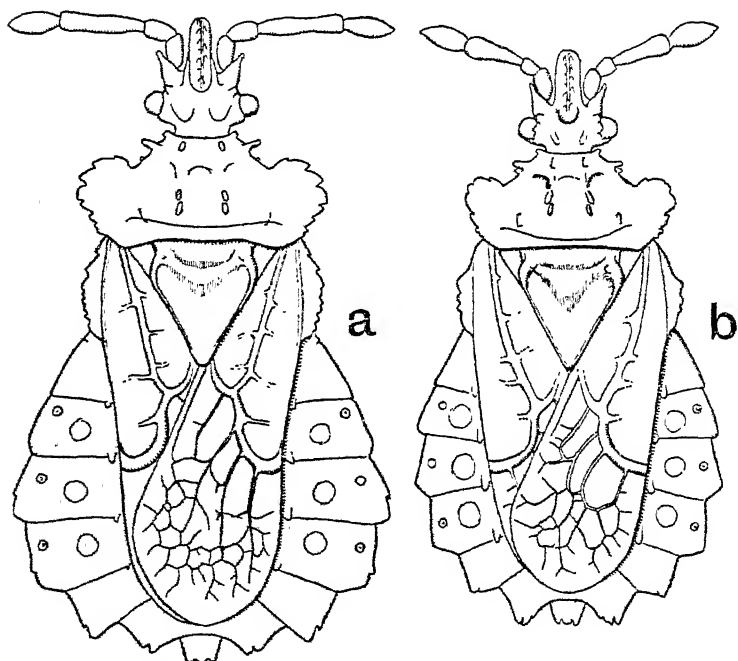
The whole insect covered with minute pale brown or whitish circular concave scales.

Head as long as broad, slightly longer than the pronotum (27 : 25); tylus at the base strongly rounded and convex, sides parallel; crest dentate; impressions of vertex very shallow and obscure, divergent anteriorly; preocular tubercles distinct, antenniferous spines moderately acute, rather short, divergent, without lateral teeth; antennae robust, about one and a quarter times the length of head, first segment extending to within one-third of the tylus from its apex, second distinctly shorter, third twice as long as first, apical half of fourth with the usual silvery white, longitudinal depressed, sensory hairs; relative length of

* Myers, 'Psyche,' xxxi. no. 6, p. 261 (1924).

segments 15, 12, 30, 25 (fig. 1, e); rostrum extending to middle of prosternum, relative length of joints 10, 12, 25, 15; pronotum more than two and one-third times as broad as long, lateral lobes moderately expanded. Scutellum longer than pronotum, only slightly longer than broad at base (68:63). Hemelytra extending to seventh ventrite, the corium to the middle of the fourth; basal expansion of exocorium well developed, slightly reflexed; vein separating mesocorium and exocorium obscure, almost obsolete.

Fig. 2.



a, *Pseudaradus cinereus*, sp. n., female; b, *Pseudaradus viridis*, sp. n., female.

Abdomen moderately expanded laterally, distinctly narrower at its widest part than the length from base of pronotum to apex of abdomen. Genital plates figured (fig. 1, f).

Total length 5.1 mm.; breadth of pronotum 1.9 mm.; greatest breadth of abdomen 2.4 mm.

1 ♀, New Zealand, Ngaio, 2. vii. 22 (T. Cockcroft), "under bark of Rimu" (*Dacrydium cupressinum*). Type in British Museum.

This species is remarkable as being the only green Aradid

so far described. Unfortunately, nothing is known of its summer habits, as this specimen was taken at the beginning of July, the coldest time of year, and was undoubtedly wintering under bark. The green colour suggests that this species may live amongst the leaves of the Rimu tree (*Dacrydium cupressinum*). If this is so, the rarity of the insect would be explained, since this tree is a very tall one, and beating of the foliage would ordinarily be impracticable. The presence of well-developed membranous pseudarolia is also explained if the habitat is actually amongst leaves. The presence of these organs in *Ctenoneurus hochstetteri*, the only other Aradid in which they are known to occur, may be explained by the fact that this species lives under the bark of recently dead hardwood trees, especially Tawa (*Beilschmiedia tawa*), where the climbing surfaces are extremely smooth and shiny. The well-developed evaporative areas of the scent-orifices, similar to those in the Pentatomidæ, may also be connected with a life in the open.

Pseudaradus cinereus, sp. n. (Fig. 2, a.)

♀.—Opaque pale brown, covered with whitish circular concave scales, giving the insect a greyish-brown appearance; lateral lobes of pronotum and basal lobes of exocorium with a faint trace of green; eyes, fourth segment of antennæ, apex of third, apical segment of rostrum, apex of scutellum, apical margin of corium narrowly along the inner side of marginal vein, and the femoral and tibial annulations brownish black. Sternum and venter dark ferruginous brown, becoming a light chestnut-brown on the disc of the venter and down the middle of the sternum. First two antennal joints pale brown with some irregular dark markings, third joint dark brown, becoming darker towards the apex, with a median pale annulation, fourth joint black, the apical half with the usual depressed longitudinal silvery sensory hairs (fig. 1, c), apices of second and third segments of rostrum pale. Legs similar to those of *P. viridis*, but with the brown markings darker and more distinct. Membrane ash-grey with the veins and the centres of the cells brown.

Head slightly longer than broad, longer than pronotum (32:28); tylus at base rather compressed laterally, not strongly rounded and convex, sides parallel, crest dentate; impressions of vertex broad, practically obsolete; preocular tubercles distinct; antenniferous spines moderately acute, short, divergent, without lateral teeth; antennæ moderately robust, nearly four times the length of the head, first

segment extending to within one-quarter of tylus from its apex, second slightly shorter, third nearly three times the length of first, fourth one and a half times the length of first; relative length of segments 20, 18, 52, 30; rostrum extending not quite to the middle of the prosternum, relative length of segments 11, 13, 23, 18. Pronotum more than two and a third times as broad as long, lateral lobes strongly expanded and more semicircular in outline than in *P. viridis*. Scutellum longer than pronotum, longer than broad at base (77:64), distinctly longer than in *P. viridis*. Hemelytra extending to seventh ventrite, the corium to the base of the fourth; basal expansion of exocorium moderately developed, slightly reflexed. Abdomen strongly expanded laterally, as broad at its widest part as the length from base of pronotum to apex of abdomen. Genital plates figured (fig. 1, d).

Total length 5.9 mm.; breadth across pronotum 2.3 mm.; greatest breadth of abdomen 3.5 mm.

2 ♀ ♀, New Zealand, Korokoro, 13. x. 1923 (*T. Cockcroft*), "under bark." Type in British Museum.

This species is easily distinguished from *P. viridis* by its greater size, the longer third antennal joint with the pale annulation, the more rounded lateral pronotal lobes, longer scutellum, and much broader, more dilated abdomen.

In the British Museum there are two males belonging to this genus, labelled *Aradus thoracicus*, A. White, and taken in New Zealand under the bark of a tree sometime during the voyage of H.M.S. 'Erebus' and 'Terror' (1839-1843). In his Cat. Heteroptera Brit. Mus. vii. p. 40, Walker recorded these specimens from New Zealand under the "division" *Neuroctenus*, giving as a reference White, Zool. Voy. 'Erebus' and 'Terror.' But, as pointed out by Buchanan White (Ent. Mo. Mag. xv. p. 76, 1878), *A. thoracicus* has never been described, and did not appear in the List of New Zealand insects published by White and Butler in the Zoology of the Voyage of H.M.S. 'Erebus' and 'Terror,' vol. ii. (1874). *A. thoracicus* (White), Walker, is therefore a *nomen nudum*. It is possible, however, that these two males belong to *Pseudaradus viridis*, from which they differ chiefly in the much longer third antennal segment. Males of this genus have also been collected at Korokoro, 29. ix. 1923 (*G. V. H.*), and Ohakune, 1. i. 1924 (*T. Cockcroft*). These may belong to *P. cinereus* and *P. viridis* respectively, but without studying more material it is impossible definitely to associate them with the described females. Unlike the latter, the males do not show amongst themselves any great difference in the length of the third antennal segment.

L.—Two new Bittacidæ (*Mecoptera*).

By D. E. KIMMINS.

Bittacus henryi, sp. n.

♀.—*Head* light brown; rostrum becoming pitchy towards the mouth; vertex brown, pitchy between the ocelli. Between the eyes a shallow depression, fringed with pale hairs directed inwards. *Antennæ* slender, dark brown, the basal joint paler, subcylindrical, the second globular, dark brown. *Prothorax* pitchy brown, meso- and metathorax reddish brown. *Abdomen* brown, with fine yellow pubescence. *Legs* slender, brown; femora at apex and tibiæ at base and apex blackish.

Wings narrow, tips obtusely angled; pale brownish in colour, margins darker and the venation dark brown. No apical cross-vein in the costal area. Subcostal cross-vein in the fore wing just before the fork of *Rs*, and close to the termination of *Sc*; in the hind wing about midway between the fork and origin of *Rs*. Fork of *Rs* before the fork of *M*. Cubital cross-vein before the fork of *M*. No anal cross-vein. 1 *A* joins the hind margin considerably before the fork of *M*, and a little beyond the origin of *Rs*. *Pterostigma* subrectangular, connected with *R*₂ by two cross-veins. A few bristles on the hind margin of wing near base.

Fore wing 15 mm.; hind wing 14 mm.

Length of body 14 mm.

1 ♀, Vavunya, N.P., Ceylon, 17. xii. 23 (*G. M. Henry*).

Type. British Museum (presented by the Colombo Museum).

The specimen differs from *B. insularis*, Esb.-P., in the position of the subcostal cross-vein in both fore and hind wings, in the position of the fork of *Rs* in relation to that of *M*, and also to that of the cubital cross-vein. From *B. indicus*, Walk., it differs in the position of the subcostal cross-vein and in its much shorter 1 *A*.

ANOMALOBITTACUS, gen. nov.

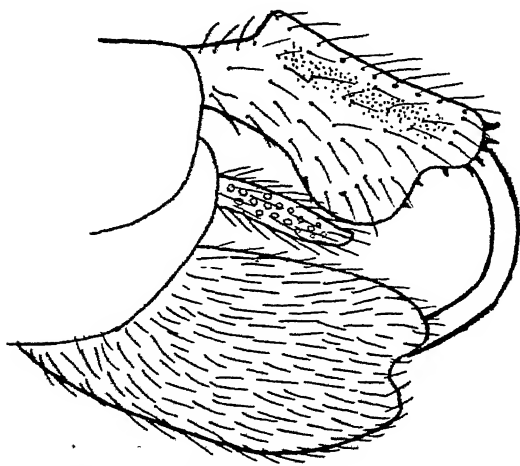
Male with vestigial wings; female as yet unknown. The three thoracic segments subequal. The basal joint of the hind tarsus longer than the second and third together and longer than the fourth.

This genus differs from *Apterobittacus*, McLachlan, in

possessing rudimentary wings in the male and in the relatively greater length of the basal joint of the hind tarsus.

Anomalobittacus gracilipes, sp. n.

♂.—*Head* pale brown, between the ocelli shining blackish. *Antennæ* brown, longer than the thorax, the two basal joints large. *Thorax* and *abdomen* brown. Anterior margin of prothorax with a number of black bristles. *Wings* present, but reduced to slender slightly curved filaments about two-thirds of the length of the thorax. *Abdomen* covered with short yellowish pubescence. *Legs* the same colour as body, apices of tibiæ and the tarsi darker.



Anomalobittacus gracilipes, ♂, sp. n. Anal appendages.

Superior appendages, viewed laterally, slightly concave, with the upper distal angle produced, rounded, and bearing a number of short black spines; lower distal angle rounded, inferior margin feebly concave to base.

Inferior appendages with the upper and lower margins slightly convex, apex excavate.

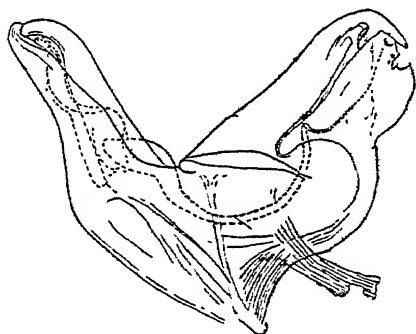
Length of body 14 mm.

1 ♂, Cape Town, 18. xi. 15 (K. H. Barnard).

Type. British Museum.

LI.—*Notes on Myriapoda*.—XXXI. *More about Iulus latistriatus*, Curtis. By the Rev. S. GRAHAM BRADBIRKS, M.Sc. (Manch.), D.Sc. (Lond.), F.Z.S., Lecturer in Zoology and Geology, South-Eastern Agricultural College (University of London), Wye, Kent.

IN the sixteenth and seventeenth papers of this series we referred to our examination of a number of dried specimens of millipedes and centipedes preserved in the collections of the British Museum (Natural History), London. One of the species considered in those papers was *Cylindroiulus latistriatus* (Curtis, 1844). In external appearance Curtis's specimens, which we regarded as his types, agreed with *Iulus britannicus*, Verhoeff, 1891. *Iulus britannicus* occurs in England in garden and greenhouse, inland. Under the



Anterior and posterior gonopods in profile, $\times 100$. S. G. B.-B. del.

circumstances we had little doubt that these were two specific names for the same animal. We advocated the restoration of Curtis's name and the rejection of that of Verhoeff.

There remained an element of doubt, because we had not examined the gonopods of the male of any of Curtis's specimens. Correspondence with continental workers who were not satisfied led me to seek permission to dissect one of the types, and through the kindness of Dr. W. T. Calman, F.R.S., Keeper of Zoology, I was able to make the necessary examination in 1927. One of the males, which had been collected in 1844 at Nantwich, Cheshire—a carded specimen which had long remained dry,—was relaxed by Mr. Browning, of the Museum staff, and I dissected this on 7th July, 1927,

and from it was able to make two slides of the limbs of the seventh body-segment, each slide being of the gonopods of one side.

The figure accompanying this note is a drawing of one of my slides. It will be seen that these are not the gonopods of *Iulus britannicus*, nor are they those of its relatives *Cylindroiulus frisius* (Verhoeff) or *C. parisiorum* (Brolemann & Verhoeff). It is evidently an entirely separate species.

I shall not add here the original description of this species, because we quoted it at length in our sixteenth paper. The specimen I dissected I called co-type A, and I now take it as lectotype of *Iulus latistriatus*, Curtis.

I tender my thanks to Dr. Calman for permission to make the dissection, and to Miss Finnegan, Assistant Keeper, as well as to Mr. Browning, for help and facilities for doing the work.

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LII.—*On the Occurrence of Cittotænia pectinata (Cestoda) in Burma.* By K. N. SHARMA (Judson College).

A SINGLE specimen was found in the intestine of a rabbit. Length 65*, greatest breadth 5.5. Proglottides approximately 85-90. Scolex 0.75 dia. Suckers 0.32 dia. Genital pore in anterior portion of proglottis margin. Genital ducts pass dorsal to longitudinal excretory vessels. Cirrus-sac 0.08 long, reaching excretory vessels. Testes 100-110, in a single row across segment posterior to female glands. Uterus tubular, with anterior and posterior diverticula.

* All measurements in mm.

Eggs absent. According to the table given by Baer (1927, 60) the species to which the present form most closely approximates is *Cittotania pectinata* (Goeze, 1782): the differences between *C. ctenoides*, *C. denticulata*, and *C. pectinata* appear but small, and may ultimately prove to be not of specific rank.

Rabbits are not indigenous to Burma, the only representative of the Duplicidentata being *Lepus peguensis*, Blyth, 1855, a form none too common. The rabbit containing the present specimens was bred and reared in the Pasteur Institute, Rangoon: the parasite must have been introduced by the food. As hares are rare, and do not occur round Rangoon, the infection was probably introduced in the first place from Europe in imported rabbits, and now is definitely established with its own intermediate host, in the country.

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- BAER, J. G. (1927.) 'Monographie des cestodes de la famille des Anoplocephalidæ.' Bull. Biol. France et Belgique, suppl.

LIII.—*A new Race of Barking Deer from Annam.* By C. BODEN KLOSS.

IN continuation of contributions in Ann. & Mag. (9) ix. pp. 87–99 (1922) and (9) xviii. p. 214 (1926) another new form of mammal is described below.

Muntiacus muntjak annamensis, subsp. n.

Paler and less rufous above than *M. m. curvostylis* (Gray) of Siam, the limbs the same yellow colour as the flanks instead of dark brown below anteriorly; muzzle also paler.

This is the palest of all the barking deer known to me, and is a great contrast to the other high-level forms, which are dark:—*M. m. feæ* (Thos. & Doria) from the mountains near Mt. Muleyit, Tenasserim, and *M. m. montanus*, Rob. & Kloss, from Korinchi Peak, Sumatra.

Types.—Adult male, no. 3558/CBK from Langbian Peak, South Annam, 5500–6500 ft., April 28th, 1918; adult female, no. 3460/CBK from Langbian Peak, 6000–7500 ft., April 19th, 1918. *Measurements in the flesh*.—Total length, ♂ 1140, ♀ 1240; tail, ♂ 175, ♀ 165; height at shoulder,

♂ 570, ♀ 600; hind foot, c. u., ♂ 290, ♀ 292; ear, ♂ 102, ♀ 98 mm.

Specimens examined.—Two females from Dalat, 4500 ft., one female from Arbret Broyé, 5400 ft., and one immature female from Camly, 5000 ft., all on the Langbian massif. Also one adult and two immature females from Daban, 650 ft., in the foot-hills of Langbian, in which the lower parts of the limbs are a little darker, one being brownish there.

Compared with four examples of *M. m. curvostylis* from Siam, its nearest ally.

BIBLIOGRAPHICAL NOTICE.

The Plant-Lice or Aphididæ of Great Britain. Vol. II. By F. V. THEOBALD. Headley Brothers, Invicta Press, Ashford, Kent. 411 pp. 1927. Price 30s.

IN 1926 we noticed the appearance of the first volume of Mr. Theobald's Monograph of the Plant-Lice of Great Britain, and now the second volume of this important work has been published. It deals with the Aphidina, Callipterina, Drepanosiphina, Phyllaphidina, and Monaphidina. As in the previous volume, the whole of the species have come under review, and much new synonymy has been established. Only one new genus has been erected and eight new species described, but this small number is largely due to the author's practice of publishing preliminary descriptions of new species when they are discovered. The sub-tribes treated comprise some of the worst pests of British agriculture and horticulture, and, though the author has elucidated many life-histories, much still remains to be done before our knowledge of even the most common species can be said to be complete. The tracing of those interesting phases of migration has always been difficult for the biological student on account of the brevity of descriptions and the non-correlation of closely-related species, but with the synoptic tables given herein and the recording of the known host-plants of each polyphagous species this should now be overcome, and the former complaint of our lack of a proper systematic understanding of the species can no longer be levelled against the specialist. It is evident that Mr. Theobald has performed a very important piece of "basic research," and the bringing together of a vast amount of information, both new and old, into a manageable compass puts every student interested in the family deeply in his debt.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[TENTH SERIES.]

No. 4. APRIL 1928.

LIV.—*New Curculionidæ from Tropical Africa (Col.).*
By GUY A. K. MARSHALL, C.M.G., D.Sc., F.R.S.

Subfamily OTIORRHYNCHINÆ.

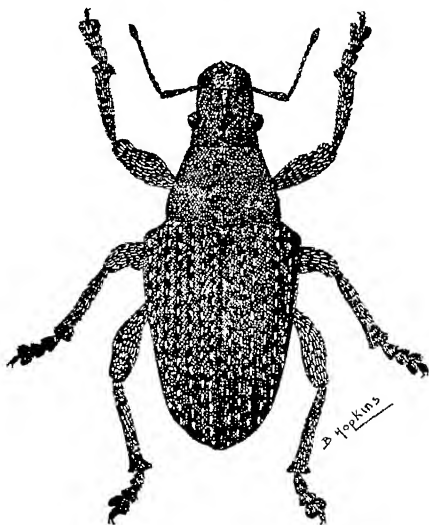
Heterostylus neavei, sp. n. (Fig. 1.)

♂ ♀. Integument black, rather shining, almost bare above in the typical Mlanje specimens, with only a few small narrow pale scales on the elytra, especially on the declivity; the lower surface with thin grey scaling, a dense fringe of white scales on the hind margin of the metasternum adjoining the hind coxæ, and dense grey scaling on the coxæ. In the specimens from Portuguese East Africa the scaling is sometimes more dense above and below, especially in ♀, in which sex intervals 1–3 of the elytra sometimes bear on the posterior half of the disk dense suberect pointed brownish scales.

Head short (the distance of the eyes from the prothorax less than their own diameter), with fine and close, longitudinally confluent punctation, and without any definite transverse impression behind the eyes; the forehead gently convex transversely, with a very deep, elongate, median fovea, which encroaches for some distance on the base of the rostrum; the eyes subcircular, very prominent, obtusely subconical. *Rostrum* unusually stout, about as broad as long, subparallel-sided, with the genæ not projecting, and without

any transverse basal furrow in front of the eyes; the dorsum almost flat, finely punctate and irregularly wrinkled longitudinally, with an abbreviated smooth median line (sometimes subcarinate), and on each side a variable short longitudinal impression; the apical fringe of yellowish-white setæ unusually long and dense, and the setæ lanceolate; the mandibles with similar but shorter dense setæ, and the mentum densely setose; the scrobes usually bare, deep and narrow, only slightly widening outwardly, with the upper edge touching the lower margin of the eye. *Antennæ* with the scape unusually short, not reaching the base of the eye;

Fig. 1.

*Heterostylus neavei*, sp. n.

the funicle with joint 1 a little shorter than 2, but sometimes equal to it, and joint 7 slightly longer than broad. *Prothorax* trapezoidal, widest at the base and gradually narrowed (with the sides straight) to two-thirds, thence narrowing a little more rapidly to the apex, the apical margin having a narrow fringe of pale scales; the dorsum almost plane longitudinally, moderately convex transversely, but somewhat flattened in the middle of the basal half, closely set with unequal punctures, which are more or less transversely confluent in the middle and laterally at the apex, and with a smooth median line in the basal half which is

shallowly impressed before the base; the setæ sparse, scale-like, and recumbent. *Scutellum* with dense overlapping scales, and closely punctate when bare. *Elytra* triangular, widest at the very prominent shoulders and rapidly narrowing to the apex; the striæ broad and deep, set with deep punctures separated by about their own length, and each containing a conspicuous elongate pale scale; the intervals subcostate, not much wider than the striæ, the dorsal ones with dense fine punctures and transverse wrinkles, the lateral ones sparsely punctate, scarcely wrinkled, and more shiny. *Legs* with the femora punctate in wrinkles; the hind tibiæ with a deep longitudinal sulcus on the upper half of the inner face and with a few coarse teeth on the apical half of the lower edge. *Sternum* with two perpendicular processes immediately behind the front coxæ.

Length 8.5–20.0 mm., *breadth* 3.7–7.3 mm.

NYASALAND: Mt. Mlanje, 23 ♂♂, 54 ♀♀, i.–v. 1913, xii. 1913 (*S. A. Neave*). PORTUGUESE E. AFRICA: Ruvo Valley, 2000 ft., 2 ♂♂, 2 ♀♀, 9. iv. 1913; Kola R., near Mt. Chipirone, 1500–2000 ft., 11 ♂♂, 7 ♀♀, 6. iv. 1913 (*Neave*).

The genus *Heterostylus*, Fst., 1890, is by no means a homogeneous one, and when more species are known it will probably be convenient to divide it up. The present species differs from all the other species known to me in its very broad rostrum, very short antennal scape, short second funicular joint, the prosternal processes, the dense oral setæ, and in the absence of the transverse impression between the forehead and vertex. It is also remarkable in having lost the characteristic transverse furrow between the eye and the rostrum, which is represented merely by a faint impression; but this condition is also to be found in the equally aberrant *H. cuspidatus*, Fst., 1894.

The extraordinary range in size is not correlated with sex, both the largest and the smallest specimens examined having been females.

Dicasticus albonotatus, sp. n.

♀. Derm black, with dense brownish-grey scaling and with sparse whitish spots on the elytra; the rostrum with blue-green or brown and blue-green scaling; the forehead in the middle and the vertex with blue-green scaling; the elytra with the whitish spots forming interrupted rows on the alternate intervals; the antennæ and the tarsi with pale blue or greenish scaling; the lower surface pale fawn, with a broad subdenuded median stripe on the venter.

Head with short suberect setæ on each side of the forehead; the eyes prominent, semicircular. *Rostrum* nearly as broad as long, parallel-sided in the basal half, with the genæ roundly dilated; the median dorsal area flattened and with a low narrow bare median carina. *Antennæ* with the scape gently curved, gradually clavate, densely squamose, and with numerous stiff suberect brown setæ; the funicle only slightly narrowing to the apex, with all the joints longer than broad, their relative lengths in order: (1, 2), 3, 7, (4, 5), 6. *Prothorax* transverse (4:3), parallel-sided or slightly widening from the base to beyond the middle and thence narrowing to the apex, but not constricted, and truncate at base and apex; the dorsum somewhat flattened in the middle, the sculpture hidden by scaling, through which are visible rather numerous minute shining granules, each bearing a very short dark erect seta; a broad median stripe and a small rounded area on each side behind the middle free from granules. *Elytra* ovate, widest not far from the base, obtusely acuminate behind, with a small low white-scaled callus before the apex which does extend inwards beyond stria 2; the rather large shallow irregular punctures showing through the scaling only as minute points; stria 1 bare of scaling from the base to the middle or to the top of the declivity, the septa between the punctures being raised into small rounded tubercles; the rows of white spots all somewhat raised; the intervals with numerous irregular short stiff erect setæ. *Legs* piceous, the tibiæ and base of the femora with fawn scaling, the rest of the femora dark, the two posterior pairs having a large whitish subapical patch.

Length 12 mm., breadth 6 mm.

TANGANYIKA TERR.: Turiani Mts., vi. 1922, 3 ♀ ♀ (*A. H. Ritchie*).

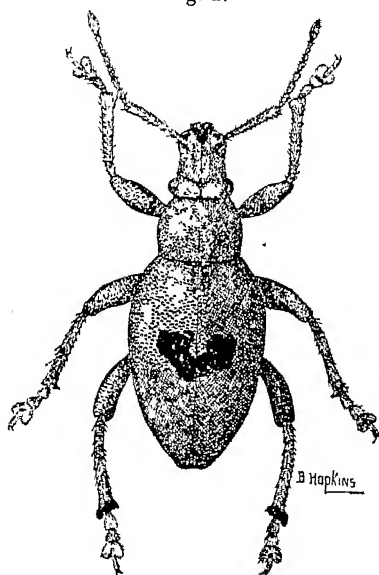
Dicasticus ritchiei, sp. n. (Fig. 2.)

♂ ♀. Derm black, with dull green scaling; the head and rostrum with mostly fawn-coloured scales above and more green laterally; the antennæ pale green or blue; the prothorax dull green, with fawn scales along the basal and apical margins, and on the pleuræ a fawn stripe from the base to the middle; the elytra dull green, with a small bare patch at the base of the suture and a large common transverse kidney-shaped bare patch about the middle, a macular pale buff or whitish stripe along the apical half of the lateral margin, and frequently with rows of whitish dots on

intervals 2, 4, 6, 8 at the sides and apex only; the lower surface fawn-coloured, more or less variegated with green scales, the venter with a broad subdenuded median stripe.

Head, rostrum, and prothorax as in *D. albopunctatus*, sp. n., except that the rostrum is distinctly longer than broad and the impression on each side of the epistome is much shallower, and the apical margin of the pronotum is distinctly sinuate. *Antennæ* with the funicle becoming much narrower from base to apex, otherwise as in *D. albopunctatus*. *Elytra* ovate, obtusely acuminate behind in ♀, less acuminate in ♂, with a small subapical callus, which comes nearer to the apex

Fig. 2.



Dicasticus ritchiei, sp. n.

than that in *D. albopunctatus* and reaches stria 1; the basal margin raised into a bare callus at the suture, behind it two or three low bare rounded tubercles on each side of the suture, and about the middle a coarsely punctate common bare irregular kidney-shaped callus extending to stria 3 or 4; the irregular shallow punctures hidden by the scaling or showing through as small points, the intervals with irregular short erect dark setæ. *Legs* with the base of the femora, the tibiæ, and the tarsi clothed with pale green and brassy scales, the apical two-thirds of the femora dark and subdenuded.

Length 5·1–6 mm., breadth 10·8–12 mm.

TANGANYIKA TERR.: Handeni, xi. 1926, 1 ♂, 3 ♀ ♀ (*A. H. Ritchie*).

From its congeners *D. ritchiei* can be readily distinguished by the large bare patches on the disk of the elytra. *D. albopunctatus* is nearly related to *D. gerstaeckeri*, Fst., 1893, but in the latter species the tubercles in stria 1 of the elytra are larger, more numerous, and almost contiguous, and extend on to interval 2 and stria 2; the subapical callus is almost obsolete; the granules on the pronotum are transverse, etc.

Systates infranotatus, sp. n.

♂ ♀. Integument black, moderately shining; almost bare on the rostrum, head, and pronotum; the elytra with very sparse minute narrow scales, which may be either white or pale green, and with a narrow stripe of larger scales on the extreme lateral margin on a line with ventrites 2 and 3; the lower surface almost bare, but with the following conspicuous patches of dense white scales: before the front coxæ, on the anterior lateral angle of the mesepisternum, on the triangular base of the metepisternum, and a large one on the posterior lateral angle of the metasternum, and with sparse scaling on all the coxæ and behind the front coxæ.

Head coarsely and confluent punctate, with a narrow median furrow that does not extend behind the eyes, which are moderately convex and highest in the middle. *Rostrum* strongly dilated from base to apex and only a little longer than its apical width, with the sides almost straight; the dorsal area parallel-sided from the base to the ill-defined transverse costa behind the antennæ, with a well-marked shining median carina and the lateral margins almost subcostate, the interspaces shallowly impressed and with obsolescent confluent punctures; the apical area declivous, impressed, and obsoletely punctate; a broad longitudinal costa from the scrobe to the eye, with a well-marked furrow above it. *Antennæ* with the scape slender, gently curved, and gradually clavate, with sparse punctures containing very short recumbent setæ; formula of funicle: 1, 2, 3, (5, 7), (4, 6). *Prothorax* nearly as long as broad, gently rounded at sides, widest at the middle, and truncate at the apex, which is a little narrower than the base; the dorsum closely set throughout with large low subcontiguous shiny granules of varying shapes and sizes, each bearing a very short recumbent seta near its anterior edge, the narrow interstices dull

and shagreened; the granules on the pleuræ similar but much further apart, and replaced by shallow punctures towards the coxæ. *Elytra* ovate, widest about one-fourth from base, more rapidly narrowed behind in ♂ than in ♀, slightly flattened dorsally (especially in ♂), and vertically declivous at the base; the posterior declivity sinuate (viewed laterally), vertical in ♂, overhanging in ♀; the striæ shallow, containing shallow punctures separated by small rounded granules; the intervals broader than the striæ (but much narrower in ♂ than in ♀) and bearing larger flattened shiny granules separated by shagreened interstices, each granule bearing a minute recumbent seta on its posterior edge, and the granules obsolete on the lateral intervals. *Legs* with sparse pale setæ; the hind femora of ♂ with a row of granules along the lower edge; the tibiæ (♂ ♀) spinosely denticulate on the apical half of the lower edge of the two anterior pairs, and the hind pair simply denticulate nearly to the base and with rows of granules on the inner face; the hind tibiæ of ♂ not curved or distorted, similar to those of ♀ and with similar setæ.

Length 7.2–12.0 mm., *breadth* 3.0–5.3 mm.

NYASALAND: Mt. Mlanje, 2300–6500 ft., 49 ♂♂, 39 ♀♀, xi.–xii. 1912, i.–iv. 1913, ix.–xii. 1913, i. 1914 (*S. A. Neave*).

Very closely allied to *S. smeei*, Mshl. (Bull. Ent. Res. xviii. p. 262, fig. 4, 1928), which occurs in the same locality, and differing from it principally in the sinuate declivity of the elytra, the absence of the patches of pale scales at the base of the elytra, and the presence of scales on the lateral margin; further, the metasternum and venter are sparsely clothed with erect pale setæ, whereas those in *smeei* are much shorter and recumbent, and in *smeei* the prothorax is distinctly transverse (in the ♀) and the rostrum much less dilated at the apex.

Subfamily *ALCIDINÆ*.

Alcides biangulatus, sp. n.

♂ ♀. Derm black, with the elytra red-brown; the head and the sides of the prothorax set with plumose scales dusted with a cream-coloured powder, the latter with three or four indefinite subdenuded patches; the elytra with two common, sharply angulated, parallel, narrow bands formed of pale plumose scales, the anterior one with its angle on the scutellum and its ends reaching stria 8 on a line with the hind coxæ, the second with its angle on the middle of the

suture and its ends reaching stria 7 on a level with ventrite 3; the lower surface densely clothed with broad plumose scales, which are naturally dusted with creamy or yellowish powder.

Head with the forehead broadly depressed, more so in ♂ than in ♀. *Rostrum* of ♂ about as long as the pronotum, almost straight, nearly parallel-sided, with the antennal insertion well in front of the middle, and with coarse, longitudinally confluent punctures throughout; that of ♀ a little longer and slightly more curved, with the antennal insertion at about the middle, and with the punctures much finer and only confluent at the sides of the basal half. *Antennæ* with the scape as long as joints 1-6 of the funicle, of which 1 is as long as 2+3, 3 to 6 transverse and bead-like, and 7 as long as the two basal joints of the club. *Prothorax* subconical, shorter than its basal width, gently rounded at the sides, and with a broad shallow constriction near the apex, which is slightly arcuate and about half the width of the base, the postocular lobes very feeble; the dorsum convex longitudinally, highest behind the middle, on the disk with small dense low granules that are often confluent, and at the sides with coarse confluent punctation. *Scutellum* subquadrate or transverse, glabrous, not enclosed in front. *Elytra* subtriangular, with the shoulders very prominent, and rapidly narrowing from there to the apex, the sides being straight as far as the second pale band; an oblique shallow impression behind the scutellum on each side and a distinct anteapical constriction; the dorsal outline flat in the basal fourth and then sloping rapidly to the apex; the striæ shallow and containing large quadrate punctures; the intervals narrower than the striæ and subcostate, with fine irregular punctures, those on interval 1 very dense and more or less confluent, but those on the other intervals becoming more sparse outwardly. *Legs* stout, rather densely clothed with pale plumose scales; the femora with a small stout tooth, the anterior pairs with one or two additional minute teeth beyond it; the front and middle tibiæ with the dorsal edge straight except near the base, the lower edge with a stout triangular tooth a little behind the middle and a smaller one at the inner apical angle. *Sternum* with the space between the median coxæ much broader than that between the front pair and bearing a stout erect tubercle.

Length 6.6-8.4 mm., *breadth* 3.6-4.8 mm.

PORTUGUESE E. AFRICA: Beira, 2 ♂♂, xi. 1900 (type) and x. 1904 (P. A. Sheppard). S. RHODESIA: Chirinda,

1 ♀, iii. 1907 (*D. Odendaal*). TANGANYIKA TERRITORY : Morogoro, 1 ♂, 5 ♀ ♀, bred from galls on stems of wild Malvaceæ, vii. 1922 (*A. H. Ritchie*). N. NIGERIA : Azare, 1 ♂, 1925 (*Dr. Ll. Lloyd*).

In its general form, strongly prominent shoulders, and very finely granulate pronotum, this species comes closest to *A. brevisrostris*, Boh., but may be distinguished from it by the chevron-shaped marking on the elytra with its anterior angle reaching the scutellum, and by its much longer rostrum ; moreover, in *brevisrostris* the middle tibiæ have no median tooth, and the hind tibiæ have a subapical tooth, which is lacking in *biangulatus*.

Subfamily CRYPTORRHYNCHINÆ.

Ocladius ziczac, sp. n.

♂ ♀. Derm dull black ; the elytra thinly clothed with brown hair-scales, with a very indefinite broad paler basal band from stria 1 almost to the lateral margin, a deeply trisinate transverse pale line behind the middle extending to stria 5 on each elytron, a common pale ω-shaped mark at the top of the declivity, and a pale dot at the apex of interval 3.

Head with very coarse confluent punctation and a short median carina. *Rostrum* parallel-sided in the basal third and then widening regularly to the apex, with a strong median carina extending from the base almost to the apex, on each side of it a lower narrower one extending from the forehead to the antenna, and a still smaller one below this reaching from the eye to the antenna ; the dilated apical area coarsely reticulate. *Antennæ* with the joints of the funicle in the order of length : 1, 2, 3, 4, 5, (6, 7), the last two being slightly transverse. *Prothorax* rounded at the sides, widest behind the middle, the surface very deeply and coarsely reticulate, the raised edges of the foveæ not forming longitudinal ridges (except the fine sharp median carina), but here and there subtuberculate, especially at the sides ; a broad deep transverse furrow on each side near the apex ; the dorsum sparsely set with long erect dark bristles with a few pale ones among them, but sometimes all are abraded. *Elytra* broadly oval, widest at the middle, with rows of large foveæ, which are separated in the rows by small rounded tubercles, and four basal foveæ in the first two rows more or less confluent transversely, and the four lateral rows more regular than the five dorsal ones, except in the basal fourth where they become very irregular

and rugose, the two outer rows with hardly any tubercles in the regular portion; the intervals much narrower than the foveæ, rather irregular and rugosely granulate on the dorsum, quite smooth on the regular lateral area; interval 1 with a fine carina bordering the suture from the base to the middle. *Legs*: the femora with three rows of punctures on the dorsal edge, the outer face with two deep sulci on the lower half and irregular rows of punctures above; the tibiæ broadly sulcate dorsally, the adjoining carinæ strongly denticulate (the teeth sometimes worn down), the outer (or anterior) face bicarinate, the outer apical angle with a biangulate process, and the mucro of the hind pair with a basal lobe.

Length 12–12.4 mm., breadth 5.1–5.4 mm.

TANGANYIKA TERRITORY: Morogoro, 5 ex., iv.–v. 1922 (*A. H. Ritchie*).

Nearly allied to the largest species in the genus, the South African *O. variabilis*, Fhs., 1871, which differs *inter alia* in the following characters: the rostrum is widest just beyond the antennæ and narrows from there to the apex; the foveæ on the elytra are distinctly smaller and more numerous, and the tubercles between them are reduced to granules on the dorsum and occasionally obsolete; the sub-apical pale spot on each elytron is placed on a small elevation; and the size is appreciably larger.

Camptorrhinus erectisquamis, sp. n.

♂. Derm black; the head grey-brown, and pale grey scaling at the base of the rostrum; the prothorax dorsally with a broadly lanceolate median grey stripe (widest behind the middle), and on each side of it a broad blackish stripe more or less suffused with brown, this suffusion passing transversely across the median stripe in front of the middle; the pleuræ dark grey, becoming paler on the prosternum; the scutellum grey; the elytra dark grey, with a broad, anteriorly curved, transverse, blackish band about the middle extending laterally to interval 5, and beyond that becoming brown and indefinite; on the declivity a T-shaped sutural black marking, the longitudinal line not reaching the apex, and the cross-piece extending to interval 3; the front femora grey with indefinite brown markings at the base, middle, and apex, the middle pair grey with a broad median brown band, and the hind pair with the basal half brown and separated from the blackish apex by a narrow paler band; the tibiæ mottled with grey and brown and with a dark submedian patch.

Head with the scales on the vertex flat and dense, those on the forehead more or less raised and uneven, presenting a spongy appearance, the concealed punctures strong and close. *Rostrum* slender, slightly widening at the base and still less at the extreme apex, with coarse, longitudinally confluent punctures throughout except along the median line, which is carinate in the basal half only, with a shallow punctate furrow on each side of it. *Antennæ* testaceous-brown; the joints of the funicle in order of length: (1, 2), 3, 4, (5, 6, 7); all the joints longer than broad and slightly widening from base to apex. *Prothorax* longer than broad (5:4), parallel-sided from the base to the middle, then narrowing in a curve to the apex without any constriction, the basal margin feebly bisinuate; the dorsum distinctly convex longitudinally, highest at about one-third from the base, with a very shallow broad median depression in the basal half and no median carina; the sculpture entirely hidden by the dense scales, which are curiously distorted and wrinkled into fine ridges, and set with very stout peg-like erect setæ, which are longer and denser on each side of the apex and short and scattered elsewhere; the pleuræ with quite flat overlapping scales, and the setæ here very short, sparse, subrecumbent, and almost as broad as long. *Scutellum* shortly ovate and strongly convex. *Elytra* of the usual elongate shape, with the apices divergent and the basal angles projecting slightly forwards; the regular striæ containing numerous subquadrate punctures, there being 24-25 in stria 1 from the base to the top of the declivity, and each containing an inconspicuous recumbent seta, the lateral striæ more shallow and with the punctures more or less concealed by the scaling; intervals 3 and 5 more raised than the others, having a small callus at the base and a row of very broad erect scale-like setæ (occasionally irregularly duplicated); interval 1 with similar setæ from the top of the declivity to the apex, this portion being obtusely elevated; interval 7 with a complete row of much smaller setæ, and those on interval 9 smaller still; the scaling dense and irregularly wrinkled, but not nearly so wrinkled as on the pronotum; the actual apices with a dense tuft of stout erect scale-like setæ. *Legs*: the femora with a short stout tooth, of the same shape on all the legs; all the tibiæ with a series of broad erect lancet-shaped scales along the dorsal edge and moderately compressed but not sharply carinate dorsally, the front pair only with the apical three-fourths and the two basal joints of the tarsi clothed beneath with long dense hairs, and the hind pair shallowly sinuate dorsally

and bisinuate beneath. *Sternum* with the terminal portion of the prosternal furrow projecting backwards well beyond the hind margin of the prosternum.

Length 9 mm., *breadth* 3 mm.

TANGANYIKA TERRITORY: Shinyanga, 3 ♂♂, 2 ♀♀, 6. x. 1926 (*A. H. Ritchie*).

The specimens were extracted from borings in the trunk of an *Acacia*.

Camptorrhinus gracilipes, sp. n.

♂. Like *C. erectisquamis*, but lacking the transverse black band and the sutural black marking on the elytra, and the markings on the legs similar but more indefinite.

Very closely allied structurally to *erectisquamis*, but differing *inter alia* in the following characters:—*Prothorax* with a dense fringe of upright pale setæ behind the basal margin, this being short at the sides and much longer in the middle (the setæ blackish in *erectisquamis* and equally short throughout). *Elytra* with the punctures rather larger and less definite, being more obscured by the densely overlapping and unwrinkled scales, there being only about 20 in stria 1 from the base to the top of the declivity; the erect squamiform setæ distinctly narrower. *Legs* with the tibiæ much more slender and only very slightly compressed, the hind pair deeply sinuate dorsally, the median pair shallowly so; the first joint of the hind tarsi a little longer than the rest together (10:9), whereas in *erectisquamis* it is shorter (9:10).

♀. Differs from ♂ in having the rostrum rather more finely punctate, the front tibiæ and tarsi without long hairs and the former shallowly bisinuate on the lower edge; the first joint of the hind tarsi not longer than the rest together; and the pygidium not visible on the ventral surface.

Length 9.0–9.5 mm., *breadth* 2.7–3.0 mm.

S. RHODESIA: Mpudzi R., Manica, 1 ♂, x. 1905 (*G. A. K. M.*—type); Sebakwe, 1 ♀.

Camptorrhinus capucinus, sp. n.

♂ ♀. Derm black; the head with dirty whitish scaling, with a rounded brown spot on the forehead and a variable brown band across the vertex; the prothorax and the whole of the sternum dirty whitish, except for a small brown spot in the upper lateral angle of the mesepisterna and a large semicircular blackish patch on the basal half of the pronotum, which is divided by a median stripe of pale scales;

the scutellum whitish; the elytra with mottled blackish and brownish scaling, and with the following whitish markings: a small elongate sutural spot behind the scutellum, a small spot at the extreme base of interval 7, some indefinite spots on the basal half of intervals 2 and 3, a broad diffuse transverse macular band near the declivity, an irregular apical patch, and a narrow stripe on the extreme margin from the base to the hind coxæ; the anterior pairs of femora whitish, the front pair with a median band and two basal spots brown, the middle pair with only the basal spots, the hind pair with the basal fourth whitish, the next dark brown, the next pale brown, and the apex whitish; the front tibiæ brown with the basal third whitish, the posterior pairs whitish with a brown patch at the middle and at the apex; the venter dark brown, turning to paler brown laterally, and with a median whitish stripe that occupies nearly the whole of ventrite 1, narrows to a broad triangular patch on 2, and continues as a narrow stripe to the apex.

Head with all the scales flat, but with a few short erect squamiform setæ, especially near the eyes. *Rostrum* comparatively short, that of ♂ widening at the base and less so at the apex, closely and strongly punctate, the punctures being more or less confluent in the basal half but not anteriorly, with a smooth median line on the apical half, which becomes very narrow behind the middle and disappears at some distance from the base; of ♀, less dilated at the apex, smooth and shining, with sparse minute punctures, except at the base which is coarsely punctate and squamose as in the ♂. *Antennæ* red-brown; the joints of the funicle in order of length: 2, 1, 3, 4, (5, 6, 7); the last three joints moniliform, 7 broader than the others and about as broad as long. *Prothorax* only slightly longer than broad (9:8), parallel-sided or very slightly widening from the base to the middle, then narrowing to the apex in a sinuate curve; the dorsum convex longitudinally, highest at one-third from the base, with strong close punctation, which is almost entirely hidden by the dense flat scaling, and a sharp carina occupying the middle third of the median line; a dense tuft of short stout erect pale squamiform setæ on each side of the apex and another near the lateral margin a little behind it, a group of a few similar but shorter black setæ on each side of the carina, and few scattered on the basal half. *Scutellum* ovate, very convex. *Elytra* subcylindrical, with the basal angles not produced and the apices not divergent; the punctures larger than in the preceding species, there being only 17-18 in stria 1 from

the base to the top of the declivity; intervals 3 and 5 more raised than the others, irregularly granulate and with rows of inconspicuous suberect squamiform setæ; interval 1 obtusely raised on the declivity, not granulate, but with a row of short squamiform setæ; intervals 7 and 9 hardly elevated, but with rows of sparse minute granules, especially in the basal half; interval 2 with a rounded squamose callus at the base almost as large as the scutellum, and a much narrower one on interval 4; the scales large, flat, broadly overlapping, and covering the punctures also. *Legs* comparatively short, especially the front pair; the tooth on the hind femora large and triangular, that on the anterior pairs much smaller and spiniform; the tibiæ strongly compressed, very sharply carinate dorsally, and sparsely set with very short stout erect setæ, the front pair of ♂ without long hairs and quite similar to those of ♀, the hind pair (both sexes) with the dorsal margin strongly convex at one-third from base and deeply sinuate in the basal half on the lower edge. *Sternum* with the terminal portion of the prosternal furrow only slightly projecting beyond the hind margin of the prosternum.

Length 8.5–9.0 mm., *breadth* 3.0 mm.

S. RHODESIA: Salisbury, 1 ♂, xi. 1919, 1 ♀, xii. 1920 (J. A. O'Neil).

Subfamily *ULOMASCINÆ*.

Of this aberrant subfamily hitherto only a single species has been known, and, so far as I am aware, this species is represented only by the unique type-specimen, which was described by Fairmaire in 1848 from Buquet's collection, and subsequently acquired by Pascoe, being now in the British Museum.

Within the last few years no less than three additional new species have been discovered in Tropical Africa, one of which constitutes a very interesting new genus.

Nothing is known of the habits of *Ulomascus*, but, judging by their coloration and coarsely faceted eyes, the adults are evidently nocturnal in their habits, and their appearance suggests that they may prove to be either myrmecophilous or termitophilous.

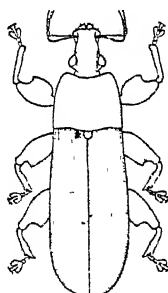
Ulomascus parallelus, sp. n. (Fig. 3.)

♂. Uniform testaceous-brown; entirely without scaling above, and with very sparse setæ that appear extremely minute even under a magnification of 35; the lower surface

with the sides of the sternum and the whole of the venter (except a median stripe on the basal ventrite) densely clothed with obliquely raised fringed scales, which in certain lights have a pale golden silky sheen.

Head broad, strongly constricted behind the eyes so as to form a distinct neck; the vertex flattened in the middle, set with coarse punctures only; the forehead broadly and shallowly depressed, with a low ridge on each side adjoining the eye, without any basal fovea and set with large punctures, many of which are separated from each other by more than their own diameter; the eyes strongly convex, rather coarsely faceted, and deepest far behind the middle. *Rostrum* (including the mandibles) a little longer than broad, narrowing in a curve from the base to the middle, then abruptly widening, the genæ being strongly dilated so as

Fig. 3.



Ulomascus parallelus, sp. n.

to form a rounded right angle; the dorsal area gradually narrowing from the base to the antennæ, flattened and very shallowly impressed, continuous with the forehead and similarly punctate; the inter-antennal area not declivous, quite flat, and more feebly punctate than the disk; the apical margin shallowly trisinate; the scrobes passing immediately beneath the rostrum, but not continued beyond the front margin of the eyes; the lower surface smooth, with dense minute shallow punctation and slightly larger punctures containing minute recumbent setæ, with a faint punctate median stria in the apical half, and in the basal half a large ovate depression rather thinly clothed with very small plumose scales and with a low median carina. *Antennæ* with the scape broad and strongly clavate, rapidly widening from one-fourth from the base, with sparse fine recumbent setæ and with no fringe on the anterior face,

compressed dorso-ventrally; the funicle with joint 7 apparently quite fused with the club so that only 6 joints are obviously perceptible, joint 1 nearly as long as $2+3+4$, and 4-6 all slightly transverse; the club (+joint 7) as long as the funicle. *Prothorax* a little broader than long, widest at the base, which is gently bisinuate and fringed with plumose scales, and gradually narrowing to the apex, which is broadly and deeply sinuate, the anterior angles being broadly rounded and fringed with recumbent scales; the dorso-lateral margins obtusely angulate in front and behind, but not carinate; the dorsum quite flat on the disk, fairly closely set throughout with deep round punctures, the intervals between them finely aciculate and mostly a little narrower than the punctures, and with very minute sparse setæ; just behind the apex a shallow transverse depression about as wide as the neck. *Scutellum* almost semicircular, shallowly depressed, impunctate. *Elytra* very elongate, more than $2\frac{1}{2}$ times as long as their basal width, almost parallel-sided, not wider at the shoulders than the base of the prothorax, jointly rounded at the apex, without any preapical constriction, separately rounded at the base, with the vertical basal declivity densely clothed with plumose scales and the basal angles rounded off; the very shallow striæ containing small punctures that are separated by about their own diameter, the four inner striæ curving slightly outwards at the base; the intervals broad, flat, and very finely aciculate, except around the shoulders where they bear small transverse carinæ, and on the deflexed margins where they are strongly punctured, so that stria 9 is almost obliterated. *Legs* with the femora very broad (the front pair the broadest), the dorsal edge being strongly convex and the lower edge laminately dilated, forming a large, sharply rectangular tooth, the carinate edge bearing a row of appressed plumose scales; the tibiæ almost straight and strongly compressed.

Length 12 mm., *breadth* 3 mm.

SIERRA LEONE: Njala, 1 ♂, 19. xi. 1926 (*E. Hargreaves*).

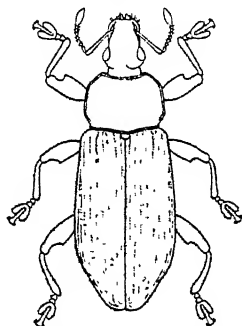
Ulomascus anaticeps, sp. n. (Fig. 4.)

♀. Colour uniform testaceous-brown, almost bare above.

Head broad, strongly constricted behind the eyes so as to form a distinct neck; the vertex convex, finely and shallowly punctate and with scattered larger punctures; the anterior part broadly depressed (leaving a narrow ridge along the inner margin of each eye), set with longitudinally confluent

punctures, and with a median fovea on a line with the hind margin of the eyes, which are very convex and deepest behind the middle. *Rostrum* suboblong, not dilated at the apex, slightly longer than broad, continuous with, and somewhat wider than, the forehead, and impressed and punctate in precisely the same manner; the sides vertical in the basal half, the dorsal area narrowing in front so that the dilated lower edge of the scrobe is there visible from above; the inter-antennal area gently declivous, shallowly impressed, and punctate like the disk; the apical margin truncate in the middle and rounded off at the sides; the scrobes passing beneath the rostrum and continued on the lower surface of the head as far as the hind margin of the eyes; the lower surface smooth, with a median stria and

Fig. 4.

*Ulomascus anaticeps*, sp. n.

fine sparse punctures, and in the basal half a large ovate depression filled with dense silky golden hairs. *Antenna* with the scape long and slender, gradually clavate, extending beyond the hind margin of the eye, somewhat compressed dorso-ventrally, and thinly clothed with minute pale recumbent setæ, which are longer and denser along the anterior edge; the funicle finely pubescent, joint 1 a little longer than 2, and 2 than 3, joints 3-7 subequal and slightly longer than broad. *Prothorax* transverse, suboctagonal, almost parallel-sided in the middle and narrowed in front and behind, not constricted near the apex, but with a distinct constriction at the base so that the basal angles project slightly; the apical margin somewhat narrower than the base, raised and gently sinuate; the base shallowly bisinuate and narrowly marginate; the dorso-lateral margins

forming a sharp, slightly-upturned carina, which extends from the apex nearly to the base; the dorsum gently convex transversely, fairly closely set throughout with distinct punctures and thinly clothed with extremely minute hairs. *Scutellum* transverse, broadly rounded behind and feebly punctate. *Elytra* oblong-ovate, almost parallel-sided, twice as long as their basal width, subtruncate at the base, jointly rounded at the apex, only slightly wider than the prothorax at the shoulders, which are rounded subrectangular; the shallow striæ with small punctures which are separated by about their own diameter, and each containing a minute seta; the intervals gently convex, feebly rugulose (transversely carinate about the shoulders), and thinly clothed with extremely minute recumbent setæ. *Legs* with the femora broad (the front pair being broader than the others), much compressed, deeply sinuate internally at the apex (the posterior angle of the sinuation forming a stout tooth), with small shallow distant punctures, and thinly clothed with short yellowish recumbent setæ; the tibiæ straight and slightly compressed. *Underside*: the venter and the sides of the meso- and metasternum fairly closely covered with yellowish plumose scales; the median area of the mesosternum bare and shiny, that of the metasternum thinly clothed with short bifid setæ.

Length (with rostrum) 10·5–12 mm., breadth 3·6–4·2 mm.

S. NIGERIA: Ibadan, 2 ♀ ♀, 3. vii. 1922 and 17. v. 1924 (*F. D. Golding*).

The genotype, *U. caviventris*, Frm., is a much bulkier insect (15 × 5·5 mm.) than either of the two new species; the head and rostrum are not hollowed out but flat, the latter is strongly dilated from base to apex, its apical edge is emarginate, there is no depressed patch of hairs on the lower surface, and the scrobes are not continued on to the head; the prothorax is not constricted at the base, the basal and apical margin are not raised, the dorso-lateral margins are obtusely angled (not carinate), and the pleural area above the front coxæ is quite vertical (not strongly inflexed); interval 10 on the elytra is set with irregular coarse punctures; the femora are still broader and more compressed, strongly punctate, and bear a fringe of long golden hairs along the dorsal and ventral edges, etc.

GENUS CRATOPECHUS, nov.

Head elongate, nearly twice as long as broad, the distance from the eyes to the thorax greater than the length of the

eyes, which are longitudinal and do not project beyond the general outline of the head; the lower surface quite flat along the middle line and with a well-marked median suture throughout. *Rostrum* porrect, comparatively narrow and elongate, four times as long as its basal width in ♂ (longer in ♀), flattened dorso-ventrally; the scrobes lateral, short, the distance from the hind margin to the eye about as long as the eye; the mentum minute, transverse, sessile within a deep emargination of the submentum; the mandibles subtriangular, sharply pointed, not overlapping, glabrous. *Antennæ* with the scape just reaching the hind margin of the eye; the funicle 7-jointed, with the first joint elongate, the other gradually widening to the apex, the 7th fitting closely to the club, which is elongate-elliptical, slightly compressed, and without evident segmentation. *Prothorax* trapezoidal, quite flat, not marginate at the base. *Scutellum* comparatively large. *Elytra* much flattened, with nine striæ; the inflexed lateral area entirely cut away behind the hind coxæ for the reception of the hind femora, so that the apical part of the elytra is absolutely flat. *Legs* with the front coxæ twice as large as the median pair, the hind pair extending to the elytral margin; all the femora very broad and very strongly compressed, and bearing a stout tooth, but the front pair much larger than the others; the trochanters very large, separating the femora from the coxæ and bearing a single seta; the tibiæ short, about half as long as the femora, fitting into a shallow groove along the inner face of the femoral tooth; the front tibiæ alone strongly bent at the base and with two blunt angular projections at the apex; the tarsi with joint 1 elongate and narrow, 2 very short and strongly transverse, 3 broadly and deeply bilobate, 4 rather flattened and widening from base to apex, and the claws simple and widely divaricate; only joint 3 spongy beneath. *Sternum* flat; the front coxæ in the middle of the prosternum, the space between them about half the width of a coxa; the mesosternum with the intercoxal process about as long as the basal portion, twice as broad as long, and with its hind margin broadly sinuate; the metasternum very long, nearly as long as broad, the main median portion widening from base to apex, without coxal excavations, the episterna narrow, the episternal sutures distinct and complete, the epimera not evident.

Genotype, *Cratopechus arundinarum*, sp. n.

This remarkable genus is obviously allied to *Ulomascus*, but the latter differs from it, *inter alia*, in its short and strongly constricted head, the very broad spatulate rostrum,

and the elongate antennal scrobes; the front coxæ are much more widely separated, the space between them being equal to the width of a coxa, and the transverse suture that separates the prosternal process from the fused epimera lies midway between the coxæ, whereas in *Cratopechus* it is in the normal position behind the coxæ.

Cratopechus arundinarum, sp. n. (Figs. 5, 6.)

♂ ♀. Colour entirely pale testaceous-brown, the head, rostrum, pronotum, and the suture of the elytra sometimes rather darker.

The whole body much flattened. *Head* very elongate behind the eyes, shallowly constricted near the base, bare,

Fig. 5.

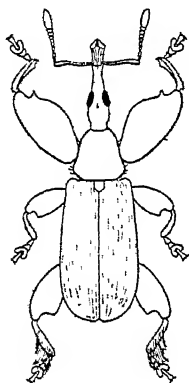
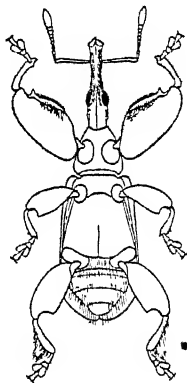


Fig. 6.



Cratopechus arundinarum, gen. et sp. n., ♂.

Fig. 5.—Upperside.

Fig. 6.—Underside.

shining and impunctate above, but with a patch of short erect pale hairs at the sides behind the eyes; the forehead narrower than the base of the rostrum, as broad as the scutellum, and with a shallow median fovea; the lower surface bare in ♀, but in ♂ with a dense fringe of long golden hairs on each side of the middle line, which is continued to the end of the rostrum. *Rostrum* (without mandibles) as long as the pronotum (♂) or one-third longer (♀), gradually narrowed from the base to the insertion of the antennæ (a little before the middle in ♂, slightly behind it in ♀), and thence markedly dilated to the apex, which is rather deeply emarginate in the middle; the dorsum

glabrous and impunctate in ♀, in ♂ finely aciculate in the basal half, with a short longitudinal impression between the antennæ and a few shallow punctures towards the apex. *Antennæ* with the scape impunctate and bare (except for a few sparse hairs), slender and compressed in the basal half, and forming a parallel-sided club in the apical third; joint 1 of the funicle as long as the next three together, joints 2-7 gradually becoming wider and successively diminishing in length. *Prothorax* subconical, widest near the base, rapidly narrowing to the apex, which is half the basal width, very slightly rounded at the sides; the base and apex both truncate, and all the angles broadly rounded, the dorso-lateral margins obtusely angulate; the dorsum quite flat, with a faint large lateral impression on each side at the middle, bare and shiny, with extremely minute punctures; a few setæ project outwardly from just below the dorso-lateral margin, especially near the basal angles. *Elytra* parallel-sided, wider at the shoulder than the prothorax, separately rounded at the apex, jointly truncate in the middle of the base as far as stria 5, the shoulders slightly and obtusely projecting forwards; the shallow striæ contain fine close punctures (the alignment of which is sometimes irregular), except the outermost one (stria 9) which is impunctate; the intervals bare, with extremely minute punctures, except interval 9 which is broader, more strongly punctate in the middle and abbreviated behind; intervals 1, 3, 5, 7 slightly more convex than the others, and the apical margin fringed with short pale hairs. *Legs*: the two posterior femora broadly elliptical, with an excision internally at the apex, the inner angle of which forms a rectangular tooth, very finely punctate, each puncture bearing a short recumbent seta; the front femora much larger than the others, flat beneath and convex above, of more irregular shape, the inner edge much more convex than the outer one, the base broadly produced beyond the point of attachment to the trochanter, an acutely projecting tooth near the apex, proximally to which (in ♂ only) the margin is denticulate and clothed with long dense recumbent golden hairs, elsewhere the surface bare and impunctate; the front tibiæ broadly flattened internally and (in ♂ only) obtusely denticulate along the edges and clothed with golden hairs on the dorsal face; the other tibiæ simple, but the hind pairs (in ♂ only) densely clothed with long golden hairs that project as a long fringe on the dorsal face, there being similar hairs on the first joint of the tarsi.

Length 18-18.8 mm., *breadth* 6.2-6.6 mm.

KENYA COLONY : Chari Falls, Thika, near Nairobi, 4 ♂ ♂, 1 ♀, i. 1921 (*A. F. J. Gedye*).

Mr. Gedye informs me that this very interesting insect was found on reeds, and as the remarkable development of the front femora occurs in both sexes, it seems possible that these limbs may be used to enable the insects to force their way between the leaf-sheath and the stalk of the reed.

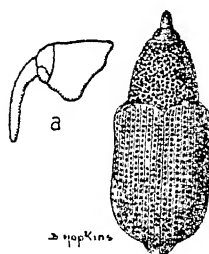
Subfamily *BARIDINÆ*.

Baris conicollis, sp. n. (Fig. 7.)

♂ ♀. Derm dull blue-black, without scaling.

Head alutaceous, with a few scattered punctures, separated from the rostrum by a deep impression. *Rostrum* comparatively long and slender in ♀, longer than the pronotum (10:7), gently and regularly curved, but little compressed dorso-ventrally at the apex, with the antennæ inserted at

Fig. 7.



Baris conicollis, sp. n.

a, side view of head and prothorax.

two-fifths from the base, the basal part rugose and with dense coarse shallow punctures, the remainder smooth and with fine scattered punctures, and the mandibles tridentate; rostrum of ♂ much shorter and thicker, about as long as the pronotum, more flattened at the apex, coarsely punctate throughout, and with the antennæ inserted at the middle. *Antennæ* with joint 1 of the funicle as long as 2-4 together, 2 as long as broad, the rest transverse and gradually widening outwardly. *Prothorax* about as long as its basal width, subconical, widest at the base, regularly narrowing to the apex, with the sides almost straight and the subapical constriction very shallow; the apex truncate, the base with the margin slightly raised in the middle and with the median angle rounded; the dorsum slightly convex longitudinally,

highest in the middle, with a shallow transverse impression in the middle of the base, the whole surface regularly set with strong close punctures, sometimes leaving a very short smooth median line; a minute recumbent seta in each puncture. *Scutellum* small, round, with a median impression. *Elytra* much broader than the prothorax, with the shoulders more prominent than usual, feebly sinuate at the sides before the middle, widest behind the middle, jointly rounded at the apex; the striae deep, with shallow catenulate punctures, stria 9 not so much deepened at the apex as usual; the intervals much broader than the striae, flat, and each with a single row of distinct rounded punctures. *Pygidium* oblique, nearly twice as broad as long, with coarse punctures, each containing a short stout recumbent seta.

Length 2·8–3·0 mm., breadth 1·2–1·3 mm.

UGANDA: Kampala, 16 ♂♂, 20 ♀♀, iii. 1923 (*H. Hargreaves*).

The conical prothorax and the prominent elytral shoulders give this species a very distinctive appearance.

Subfamily CALANDRINÆ.

Temnoschoita bisignata, sp. n.

♂ ♀. Black, moderately shining; the elytra each with a large reddish-brown basal patch between striae 1 and 9, extending from the base to nearly one-third on intervals 2–6 and rapidly shortening on 7–9; the legs red-brown, with the apices of the femora and tibiae blackish; the pygidium more or less red-brown.

Rostrum of ♀ elongate, slender and strongly curved, impunctate on the more slender part except near its base, the thickened basal portion markedly dilated above the antennæ, coarsely punctate at the sides, with two admedian dorsal rows of punctures and a basal fovea, but without any median stria; that of ♂ slightly thicker and less curved, and with the slender part finely punctate. *Prothorax* longer than broad, parallel-sided from the base to the middle and then gradually narrowed to the apex, with a deep subapical constriction which is continued shallowly across the disk; the dorsum flat, with fine sparse punctures throughout, except for a smooth median line, and with a small fovea near each basal angle, the punctures becoming larger and denser at the sides. *Elytra* flat, with the striae distinctly narrower than the intervals (especially in ♀), the punctures wider than the striae, so that the edges of the intervals are crenulated; the intervals each with a row of

very minute dense punctures. *Abdomen* with the pygidium longer than its basal width, broadly rounded at the apex, sloping regularly to the apex in ♀, more convex in ♂, and slightly retuse at the extreme apex; the anal ventrite more pointed in ♀ and without any median impression, in ♂ with a comparatively shallow oval longitudinal impression on the apical three-fourths.

Length 8.4–10.5 mm., *breadth* 3.0–3.6 mm.

UGANDA: Mabira Forest, 1 ♂, 2 ♀ ♀, 27. ix. 1913 (*C. C. Gowdey*—type); Entebbe, 2 ♀ ♀, 10. iii. 1909, 10. x. 1910 (*Gowdey*); Kampala, 2 ♂ ♂, 3 ♀ ♀, viii. 1915 (*Gowdey*). BELGIAN CONGO: Kongolo, 1 ♀, 31. i. 1911 (*Dr. J. Bequaert*).

Very similar superficially to *T. erudita*, Duviv., 1892, but in that species the pygidium is compressed and strongly gibbous in both sexes, the perpendicular posterior declivity being as long as the coarsely punctate part of the horizontal portion; on the anal ventrite of the ♂ the impression is much broader and deeper, and in the ♀ there is a very deep transverse impression at the apex, the apical margin being sinuate laterally in both sexes; moreover, the elytral striæ are broader, and the punctation is generally stronger throughout.

The following species should also be transferred to the genus *Temnoschoita*: *Sphenophorus terebrans*, Oliv., 1807, *S. nigroplagiatus*, Qued., 1888, *S. cruciatus*, Qued., 1888, and *S. hanetii*, Qued., 1888, the last-named being synonymous with *T. terebrans*, Oliv.

Temnoschoita quadripustulata, F., 1875.

T. quadrimaculata, Gyll., 1837, and *T. quadrivulnerata*, Thoms., 1858, are synonyms of this species, of which the type is in the British Museum. Fabricius's name for this species has been overlooked, partly because Gyllenhal failed to recognize it and partly because it has been erroneously regarded as a homonym. Fabricius originally described it as a *Curculio*, and in the *Systema Eleuth.* transferred it to *Lixus*; in this latter work he also described a *Calandra quadripustulata*, which is a Barid allied to *Madarus*.

Unfortunately, Casey has caused much confusion in the genera allied to *Madarus* by treating *M. biplagiatus*, Boh., as the genotype, whereas this was fixed by Schönherr (1826) as *M. corvinus*, F. This latter species Casey has transferred to *Eudamarus*, Casey, 1922, so that this genus must fall as a synonym of *Madarus*, Schönh.

GYPSOPHORUS, gen. nov.

The species upon which this genus is based resembles a small, very narrow *Cercidocerus albicollis*, Oliv., and apart from its narrow shape it only differs from *Cercidocerus* in having the antennal club small, almost symmetrical, and similar in the two sexes; the prothorax is not flattened on the disk and has no transverse impressed line along the base; the tibiæ have two impressed rows of punctures on the outer face instead of one; and the pygidium is more elongate, being much longer than broad. The elytra have an abbreviated tenth stria, and the posterior margin of the first ventrite is straight; but in these two characters the only known African species of *Cercidocerus* differs from the typical Oriental species in having no tenth stria and the margin of ventrite 1 straight, whereas the Oriental species have a tenth stria and the margin of ventrite 1 sinuate. The wings fully developed.

Genotype, *Gypsophorus albidiventris*, sp. n.

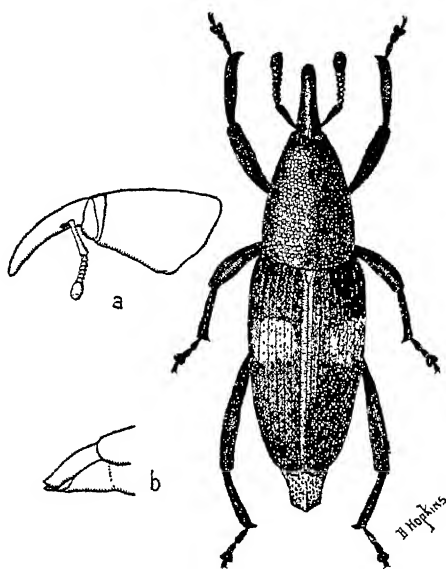
Gypsophorus albidiventris, sp. n. (Fig. 8.)

♂ ♀. Derm dull black or piceous; the pronotum, the whole of the lower surface, the pygidium, interval 1 of the elytra, and a median stripe on the base of the rostrum, covered with a chalky, whitish or yellowish-white, hard indumentum, which is abraded on the disk of the pronotum so that only the punctures are filled with it; the elytra with a small whitish patch at the base of the shoulder, and each with a large subquadrate red-brown patch in the middle between striae 2 and 8, which is often reduced and sometimes absent, or the elytra may be red-brown with the margins black; the legs black or red-brown, with more or less whitish indumentum, especially on the upper side of the femora.

Head shining, with rather scattered small punctures; the eyes separated above and quite contiguous beneath; the forehead with a large median fovea. *Rostrum* of ♂ slightly shorter than the pronotum, rather stout, moderately and regularly curved, parallel-sided in the thickened basal part and rapidly narrowing beyond the antennæ, laterally compressed, coarsely punctate except near the apex, and with a low median carina; that of ♀ a little longer, and the thinner anterior part impunctate, except in the middle near its base. *Antennæ* with the scape as long as the funicle; joint 1 of the funicle longer than 2, which is as long as broad, 3 to 6 strongly transverse; the club compressed, broadly ovate,

the pubescent part about one-third of the length. *Prothorax* longer than broad (4:3), widest at the base and very gradually narrowing to the tubular constriction at the apex, the sides very faintly sinuate behind the middle, the base rounded or feebly bisinuate; the dorsum closely and very evenly set with ocellated punctures, without any median line or carina, the punctures on the pleuræ similar but closer. *Scutellum* elongate, impunctate, normally white. *Elytra* narrow, elongate, only slightly projecting at the sloping shoulders, thence subparallel-sided to beyond the middle

Fig. 8.



Gypsophorus albidiventris, gen. et sp. n.

a, side view of head and prothorax; *b*, side view of pygidium.

and gradually narrowing behind, jointly sinuate at the base, without any subapical constriction, and with the apices separately rounded; the striæ deep but narrow, not quite reaching the slightly elevated base, the punctures wider than the striæ and separated by more than their own diameter; the intervals feebly convex and slightly uneven in parts, each with a row of minute punctures (often difficult to see), and interval 9 subcarinate. *Legs* rather slender, the femora set with large close punctures, each containing a very short seta, and with a fringe of setæ along the lower edge, which

are much longer and denser in ♂, the hind pair shortly exceeding the elytra; the tibiae with strong irregular punctures dorsally and two impressed rows of punctures on both the inner and the outer face. *Pygidium* of ♂ sloping steeply, strongly convex transversely and gently convex longitudinally, strongly and rugosely punctate, broadly rounded at the apex and there with a dense fringe of stout setæ, and with a median carina that is very high at the apex and gradually disappears before reaching the base; that of ♀ narrower and straight longitudinally, the apical fringe being shorter and less dense.

Length 7·5–8·4 mm., *breadth* 2·4–2·7 mm.

UGANDA: Entebbe, '9 ♂♂, 6 ♀♀, xi.–xii. 1912, iv.–v. 1914 (*C. C. Gowdey*); Daro Forest, 4000–4500 ft., Toro, 2 ♂♂, 3 ♀♀, x. 1911 (*S. A. Neave*—type); Budongo Forest, 3400 ft., Unyoro, 1 ♂, xii. 1911 (*Neave*).

LV.—*A new Trilobite, Acidaspis (Pseudomonaspis) magnospina, from the Coniston Limestone.* By C. J. STUBBLEFIELD, Ph.D., A.R.C.Sc., F.G.S.

[Plate XIV.]

INTRODUCTION.

Material comprising this species occurs as casts and moulds in a blue-grey flaggy limestone, which has been slightly cleaved; it was collected in August 1927 by Dr. G. H. Mitchell and the writer from the Applethwaite Beds of the Coniston Limestone Series exposed as a crag on Applethwaite Common, $1\frac{7}{12}$ miles N.E. of Troutbeck Church and $\frac{3}{4}$ mile east of Long Green Head Farm, Westmorland.

The fauna found in immediate association with the *Acidaspis* includes *Calymene planimarginata*, Reed (common), *Trinucleus (Tretaspis) seticornis*, Hisinger (rare), *Tentaculites anglicus*, Salter (common), *Plectambonites transversalis* (Dalm.), corals, and polyzoa.

The *Acidaspis* is of interest mainly because of the unique character of its neck-spine and is probably that recorded by Marr in 1892* as "*Acidaspis*, n. sp.," from the "Sleddale Group of Pusgill and Applethwaite."

It has already been stated by Bernard† that the presence

* Geol. Mag. 1892, p. 108.

† H. M. Bernard, 1892, 'The Apodidæ' (Nature Series), Macmillan, p. 214, fig. 48.

of backwardly projecting spines on the posterior margins of the *Acidaspis* cephalon suggests the possible tendency for the production of a dorsal thoracic-cover in trilobites, similar to the carapace-cover developed in the Crustacea. The finding of the primitive Middle Cambrian crustacean *Marella splendens*, Walcott, revived speculation concerning the ancestry of the crustacean carapace; *Marella* shows two pairs of long backwardly directed cephalic spines, which are considered to throw light on the problem and were further compared by Dr. A. H. Clark* respectively with the genal and occipital spines of *Acidaspis* (some species of which have a pair of occipital spines).

The Crustacean Carapace—*i. e.*, the superficial dorsal skeletal covering of the animal—has long been thought to have originated “as a fold of the integument from the posterior margin of the cephalic region”†; that such a covering in embryo appeared to be evolving independently in the genus *Acidaspis* is confirmed by the length and breadth of the neck-spine of *A. magnospina*. By analogy with other species, of which both cephalon and thorax are found attached together, the neck-spine of this species must have extended almost to cover the whole of the dorsal surface of the thoracic axis.

It is concluded that the conditions under which *A. magnospina* lived were probably physiologically somewhat similar to those occurring when the crustacean carapace was first evolved.

A further feature in this species worthy of remark is the ventral and backward inclination of the neck-spine, in consequence of which the thorax could never form a plane continuous with that of the cephalon, and forward motion of the animal would therefore probably be of a specialised type.

We have five cephala of *A. magnospina* in various states of preservation and numerous spine-fragments: there is also an isolated pygidium and part of a thoracic segment which may probably belong to this species.

The holotype is a cephalon which exists as an internal cast (Pl. XIV. fig. 2) and as an external mould (Pl. XIV. fig. 1). The dorsal cephalic exoskeleton has suffered solution laterally and posteriorly, so that, whilst the greater part of the cephalon leaves an *internal cast*, the free cheeks and most of the occipital spine are preserved, not as internal

* In C. D. Walcott, 1912, ‘Cambrian Geology and Palaeontology,’ *Smithson. Miscell. Coll.* vol. lvii. No. 6 Publ. 2051, p. 162, footnote.

† W. T. Calman, in Ray Lankester’s ‘Treatise on Zoology,’ pt. vii. 3rd Fascicule, p. 6 (1909).

casts, but as "*internal moulds*"—that is, as moulds of the ventral surface of the dorsal shell. As seen from the *external mould*, the occipital spine is separated from the rest of the cephalon by what is here called the "*occipital furrow*." This furrow is also found in counterpart on the internal cast, but another transverse furrow occurs behind this (Pl. XIV. fig. 2), developed, however, as an *internal mould*. For the purposes of this description the region between the two transverse furrows will be termed the "*apparent occipital ring*" and the more posterior furrow the "*post-occipital line*." This last furrow, or line, represents a transverse ventral thickening of the shell composing the hinder margin of the spinose "*apparent occipital ring*," and is really a ventrally-directed ridge.

DESCRIPTION.

Cephalon broad, of crescentic outline, with three prolonged spines, two of which are genal and one occipital; surrounded laterally by a flattened border which narrows anteriorly and is marked off by a shallow furrow.

Pre-glabellar field absent; *Pre-glabellar furrow* narrow but deep and probably coincident with *front-furrow*.

Glabella * very prominent; broadly sub-cordate in outline, widest posteriorly; length about five-sevenths breadth; rises rapidly from pre-glabellar furrow (which it slightly overhangs) to attain a maximum elevation just behind the antero-lateral lobes, the gradient, however, falls at first gradually and later very rapidly to the occipital furrow.

Central Lobe in shape practically semi-cylindrical, expanding in front and also a little posteriorly, where it occupies more than one-third the glabellar width.

Two pairs of *lateral lobes*, only slightly depressed below central lobe, from which they are completely separated by deep longitudinal furrows.

Antero-lateral lobes strongly convex; of ovate outline, with long axes directed obliquely outwards.

Postero-lateral lobes also strongly convex on all sides; larger than anterior pair; of uniform outline, indented on the inner sides and each with long axis parallel to the axial line; extend beyond level of posterior end of central lobe.

Occipital furrow strong, arched forwards, deeply sunken immediately behind postero-lateral glabellar lobes.

Apparent Occipital ring long medianly, one half the length of preceding part of cephalon; thickens posteriorly into a strong transverse ventral ridge, which leaves a deep transverse furrow on the internal mould; produced backwards into a stout spine, which tapers gently back.

Occipital spine in length at least three times that of glabella; initially lying in the same general plane as glabella, then deflected

* Not including the apparent occipital ring.

ventrally. The dorsal shell (Pl. XIV. fig. 1) is convex from side to side, and, from the occipital furrow backwards, is evenly studded with tubercles of three main sizes. The lower or ventral shell (Pl. XIV. fig. 2) behind the "post-occipital line" is flat or slightly concave from side to side, and laterally shows a row of large tubercles, which may possibly develop into small ventrally directed spines; adjoining the "post-occipital line" is a slightly dorsally-raised triangular area, the apex of which is prolonged posteriorly as a narrow and long median dorsally-raised ridge.

Axial furrows diverging posteriorly to become almost parallel at the postero-lateral lobes, where they deepen in their descent to meet the occipital furrow.

Fixed cheeks very narrow, arching slightly outwards to narrow again at the anterior end of the wide and elevated palpebral lobe; narrow again behind this lobe, then there is a great lateral increase in breadth.

Cheek-roll longitudinally very convex, rising to a maximum elevation just before the level of the posterior end of the palpebral lobe, followed by a rapid fall in gradient to the pleur-occipital furrow, which it overhangs; maximum breadth below and behind the palpebral lobe; describes a curve parallel to that of axial furrow.

The narrow *ocular ridge*, originating in the expanded anterior end of the glabella, runs backwards parallel to the cheek-roll, from which it is separated by a slight furrow.

Whilst the pleur-occipital furrow forms an angle of approximately 90° with the axial line, the posterior boundary of the fixed cheek forms barely 60° .

The *breadth of the cranium* posteriorly is about twice its length (measured to the post-occipital line).

Facial Suture. Anterior branch, crossing the front margin just outside the glabella, runs obliquely backwards and outwards, and becomes sub-parallel to the glabellar axis shortly before reaching the eye. Posterior branch runs out and back at an angle of 80° to glabellar axis for two-thirds of its course, then it decreases this angle to meet the posterior margin near the base of the genal spine.

Free cheeks sub-triangular in outline, widest at the level of the eyes; arched outwards and each fringed with about twelve horizontal spines, which are strongest towards the base of the genal spine; gradient descends abruptly from the eye to lateral border-furrow; inside this border-furrow the shell is much thickened and strongly raised.

Lateral border almost horizontal and fairly narrow, especially anteriorly. *Lateral border-furrow* shallow.

Genal Spines circular in section; stout; directed outwards at an angle of 30° to 50° to the glabellar axis, but the angle rapidly decreases to zero. In length they exceed that of the spineless cephalon; the ventral shell is but slightly tuberculated, though laterally a short row of tubercles continues the line of the cheek fringing-spines.

Eyes small, but protuberant; placed at level of occipital furrow; in outline ovoid; directed obliquely forwards.

The cephalon is ornamented on the dorsal surface with rather large tubercles of different sizes, except in the furrows, which are smooth.

A damaged thoracic pleura of the left side (Pl. XIV. fig. 6) has been found which probably belongs to this species. It has its front and back edges straight, parallel-sided, and horizontally extended with the outer portions bent obliquely

backwards. A slight anterior marginal ridge is bounded posteriorly by a broad and strong furrow, the hinder margins of which form the front walls of a straight and somewhat broad sub-central ridge, with a more narrow depressed posterior band. The anterior ridge is produced into a fairly stout spine, which is obliquely bent down and back (in Pl. XIV. fig. 6 perspective fails to allow the strength of this spine to be appreciated), the sub-central ridge (which is very thick and leaves a furrow visible on the *internal mould*) broadens at its outer extremity, rising into a prominent knob, and beyond this bends back at about 120° into a long and strong tapering spine.

The figured pygidium (Pl. XIV. fig. 5) is preserved as a slightly damaged external mould; it may also belong to this species, and a short description is given.

Semi-ovoid in outline; breadth about twice the length (excluding spines); provided with at least five pairs of marginal spines.

Axis convex, particularly anteriorly; tapers posteriorly to end in a broad curve in front of margin; composed of at least three rings, probably four.

Lateral portions fairly flat as far as yet observed; with a lateral and posterior bounding-ridge, which is produced marginally into spines, apparently directed downwards and outwards. The ante-penultimate axial ring is continued laterally as a pair of strong pleural ridges, which prolong themselves into spines, stronger and stouter than any of the other pygidial marginal spines visible in the specimen. It is questionable whether this ante-penultimate segment should be considered as the first or second pygidial segment; two pairs of shorter marginal spines certainly lie before and behind the long spines. Of these the most anterior pair are inclined at 50° to the pygidial axial line and the succeeding pairs show progressively smaller angles, the fifth pair being subparallel.

REMARKS.

The species is at once distinguished from all other *Acidaspidæ* by the great length and strength of the single occipital spine. It is, however, most clearly related to the group containing *A. brightii*, Murch., *A. grayi*, Barr., and presumably also *A. asteroides*, Reed, despite Reed's opinion* that this last species belongs to the subgenus *Leonaspis*. R. & E. Richter† defined the subgenus *Pseudomonaspis* with

* Geol. Mag. 1925, p. 428.

† "Ueber die Einteilung der Familie *Acidaspidæ*," Centralbl. f. Min. etc. 1917, pp 464-466.

A. brightii as the type-species and *A. grayi* and *A. quinquespinosa*, Salter-Lake, as geno-paratypes, but Reed rightly excluded the latter species. *Pseudomonaspis* was described by the Richters as an aberrant subgenus with a single spine emanating from the swollen occipital ring (characteristic of the group *Miraspinae*), and not from a single occipital tubercle as in *Leonaspis*; the facial suture was stated to bend strongly towards the glabella, closely following the ocular ridge; "the outer cheek triangle" (äussere Wangendreieck) was consequently narrow and "disappearing"; the outer pleural spine, they said, was often strongly developed. The cephalon of the new species differs from that of *A. brightii*, *A. grayi*, or *A. asteroides* by :—

(1) The character and strength of the occipital spine.

(2) The strong backward deflection of the posterior margin of the fixed cheek, and, consequent upon this, the posterior part of the cheek-roll lies behind the level of the postero-lateral glabellar lobe.

It further differs from *A. brightii* by its curved ocular ridge and curved anterior branch of the facial suture and by its horizontal marginal spines.

From *A. grayi* it differs by the curved anterior branch of the facial suture, by the course of the genal spines, and by the coarser external tuberculation; similarly, it differs from the cephalon of *A. asteroides* by the absence of a third pair of lateral glabellar lobes, and possibly also in the orientation of the genal spines.

*A. brightii** is known from the Shropshire Salopian Beds, *A. grayi* from the Bohemian Étage E (Silurian), whilst *A. asteroides* is recorded from the Ashgillian Beds of Girvan.

Reed (*loc. cit. supra*, pp. 416–430), when discussing the Richter classification of the Acidaspidae, considers a new factor concerning the place of origin of the neck-spine or spines. These, he states, may arise either from the "true mes-occipital segment" or from the "postcentral lobe," which lies above it. He claims that in *Acidaspis* (*Miraspis*) *mira*, Barr., the paired neck-spines belong to what he terms the postcentral lobe, beneath which is the true mes-occipital ring, while in *A. (Prinaspis) primordialis*, Barr., the post-central lobe is stated to be absent, and the spines to arise from the true mes-occipital segment.

* Salter, Cat. Cambr. Sil. Foss. 1873, p. 50, also records *A. brightii*? from doubtful Bala Beds, occurring S.E. of Corwen.

Reed further claims that in the subgenus *Pseudomonaspis* (loc. cit. p. 426) the "Postcentral lobe [is] produced back into [a] stout single median process, with thickened meso-occipital (?) ring passing below it."

Not having seen the Bohemian specimens from the figures of which these conclusions were drawn, the present writer withholds comment, except to add that, in the description of *Pseudomonaspis magnospina*, the postcentral lobe (taken in Reed's sense) is considered as part of the "apparent occipital segment."

It is, however, just possible that, with Reed's interpretation, the "post-occipital line" of *P. magnospina* represents the true occipital furrow, and the spinose backward prolongations of the postcentral lobe and mes-occipital ring are fused together in a horizontal plane, a condition not previously known.

In conclusion, I wish to thank Dr. W. T. Calman, F.R.S., Professor E. W. MacBride, F.R.S., and Professor W. W. Watts, F.R.S., for help given me in discussions.

EXPLANATION OF PLATE XIV.

The specimens represented here as figs. 1 & 2 (holotype in counterpart) and figs. 3, 5, & 6 have been presented to the British Museum (Natural History), S.W.7.

Acidaspis (*Pseudomonaspis*) *magnospina*, sp. n.

- Fig. 1. External mould of cephalon (holotype). $\times 2\frac{1}{2}$.
 Fig. 2. Internal cast (but preserved laterally and posteriorly as internal mould *) of cephalon, counterpart of specimen shown in fig. 1 (holotype). *a.f.s.*=anterior termination of facial suture; *p.f.s.*=posterior termination of facial suture. $\times 2\frac{1}{2}$.
 Fig. 3. External cephalic mould of younger individual, shows well the great length of the neck-spine, and is preserved close to specimen drawn as fig. 1. $\times 2\frac{1}{2}$.
 Fig. 4. Internal cast (preserved as internal mould laterally and in the posterior part of neck-spine) of cephalon. $\times 2\frac{1}{2}$.

Acidaspis ? *magnospina*.

- Fig. 5. External mould of pygidium. $\times 2\frac{1}{2}$.
 Fig. 6. One of the pleuræ of the left side of thorax, preserved at its outer bi-spinose extremity as an internal mould and at its inner end as an internal cast. $\times 2\frac{1}{2}$. (See p. 430.)

* The term "internal mould" here means the mould of the ventral surface of the dorsal trilobite-exoskeleton.

LVI.—*Contribution to the Knowledge of the Genus Nepa*
(Hemiptera : Nepidae). By TEISO ESAKI.

[Plate XV.]

ALTHOUGH the genus *Nepa*, Linné, s. str., is well known, hitherto only five species* were known to science.

These are :—

1. *Nepa cinerea*, Linné, 1758 (= *Nepa rubra*, Linné, 1758) †.
Europe, N. Africa, Siberia, China, etc.
2. *Nepa apiculata*, Uhler, 1862.
N. America.
3. *Nepa hoffmanni*, Esaki, 1925.
N. China.
4. *Nepa primitiva*, Montandon, 1913.
Tropical E. Africa.
5. *Nepa seurati*, Bergevin, 1926.
S. Tunis.

Here in the present paper I add another new species from Morocco, and give some other notes on the known species.

* Besides these five species another species was recently described from Canton, S. China, by W. E. Hoffmann under the name *Nepa chinensis* (Lingnaam Agric. Rev. Canton, iii. p. 39 [1925]), but his description was very insufficient and so careless that no statement concerning the size was given, except that the species was "smaller" than *N. apiculata*, Uhler, and *N. cinerea*, Linné, and that "the respiratory tubes" were "as long as in *N. cinerea*." Although very small, it may be very possible that, as was suggested to me by Prof. H. B. Hungerford, this species does not belong to *Nepa* but to *Laccotrephes*, since it is "less broadly oval than *N. cinerea* and *apiculata*."

Nepa annulipes, Kolenati ('Meletameta Entomologica,' no. 4, p. 481 [1851]), from Caucasus, is identical with *Nepa cinerea*, Linné, as has been already proved by Kiritschenko (Memoir Mus. Caucase, ser. A, no. 6, p. 171 [1918]). Judging by the measurements given by Kolenati—i. e., "Long. 5-7½ lin., cum seta 9¼-11¾ lin. Lat. 2¾-4 lin.,"—some of his specimens may belong to var. *minor*, Puton, which is also found in Caucasus.

† According to the rules of nomenclature *Nepa cinerea*, Linné, should be synonymized with *Nepa rubra*, Linné, which has priority over the former, as both the species are identical. See my notes: "Remarks on the Linnean Species of *Nepa* and *Laccotrephes*," Bull. Brooklyn Entom. Soc. xxi. pp. 177-181 (1926).

1. *Nepa cinerea*, Linné. (Text-fig. 1, *a*; Pl. XV. figs. 1-8.)

This commonest species of *Nepa* is known to be widely distributed throughout the Palearctic Region. In 1886 Puton described a small variety of this species from Tunis under the name *Nepa cinerea*, Linné, var. *minor*, Puton*. So far as I am aware, this small variety is very widely distributed throughout the Mediterranean Region eastwards as far as Caucasus and Persia, and it seems to be fairly distinct in size from the original form. I have examined specimens from the following localities:—Southern France (P), Spain (M), Portugal (P), Italy (G), Sicily (G), Sardinia (G), Morocco (P), Algeria (P), Caucasus (T), Persia (P). [G=Civil Museum of Natural History, Genoa; M=National Museum of Natural Sciences, Madrid; P=National Museum of Natural History, Paris; T=Georgian Museum, Tiflis.]

Presuming that this small variety may be specifically distinct from *Nepa cinerea*, Linné, I have examined the structure of the antennæ† and of the male genital appendages in several specimens from Morocco, Portugal, and Persia, but I failed to find any difference between the two forms except for size.

Besides this small variety, however, I have found two larger varieties of this species which likewise do not differ from the original form in the structure of antennæ, but only in size. Both the varieties are of about the same dimensions, generally (female) 22–23 mm. in length, which is distinctly larger than the ordinary form, which measures generally (female) 19–21 mm. One variety is found in the Mediterranean region, while the other is found in Eastern Siberia, localities which represent the two extremities of the distributive range of this species. For the former the name *major* was recently suggested by Bergevin‡, while the latter seems to be so far unrecorded in any publication. For this last, therefore, I propose a variety name, *orientalis* m., var. nov. These two varieties are of nearly the same size, but

* Enum. Hémip. Tunis., Paris, p. 8 (1886).

† The structure of the antennæ affords a very good specific character in the Nepidæ, though they are very minute in size. It was used for the first time in the classification of the family by Hungerford: "The Nepidæ in North America North of Mexico" (Science Bulletin, Kansas Univ. xiv. pp. 425–469 [1922]). The antennæ of *Nepa cinerea*, Linné, and *N. apiculata*, Uhler, are figured by him in that paper, pl. xlvii. figs. 5 & 6, and represent the most distinctive character separating the two species.

‡ Bull. Soc. Hist. Nat. Afriq. Nord, xvii. p. 294 (1926).

the differences are very constant, as shown in the photographs (Pl. XV. figs. 3-5 & 6-8), which represent three specimens of both the forms. The chief differences are as follows:—

	<i>major</i> , Bergevin, ♀.	<i>orientalis</i> , var. nov., ♀.
Shape	More oval.	More oblong.
Head	Comparatively larger, eyes more pronounced.	Smaller, eyes also smaller.
Pronotum.....	Much larger, lateral sides less convergent anteriorly.	Smaller, lateral sides more strongly convergent anteriorly.
Legs	Much stouter, especially so in the anterior femora.	More slender.
[Length of body]..	22.5 mm.	23 mm.

I have not yet seen males of either of these two varieties. The type-locality of var. *major*, Bergevin, is "Taza," Morocco. My specimens originate from Tanger, Morocco (3 ♀ ♀, National Museum of Natural History, Paris), and Gibraltar (1 ♀, British Museum, London). In the specimen from Gibraltar the shape of pronotum is not typical of this variety, but otherwise it agrees quite well with the specimens from Tanger. The types of var. *orientalis*, nov., are 3 ♀ ♀ from Amur (from two different sources), kept in the British Museum, London.

2. *Nepa dollfusi*, sp. n. (Text-fig. 1, *b*; Pl. XV. fig. 9.)

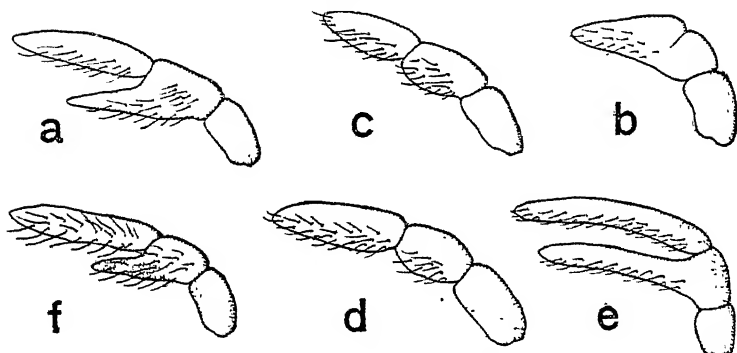
Dark sordid-brown, hind wings dark grey, dorsal surface of abdomen dark brown, antennæ sordid-yellow.

Body elongate-oval, slightly widened posteriorly. Head comparatively large, longer than between eyes, moderately convex, ante-ocular portion with a more or less distinct longitudinal elevation, posterior margin strongly convexly sinuate. Eyes very prominent, oval. Antennæ properly three-segmented, but the second and third segments more or less completely fused together*, the segmentation between them is only obscurely observable on one side, first segment very small, slightly longer than broad, second and third segments together long, thickened near the base, conically tapering towards the apex, the segmentation between the segments incompletely represented by a shallow suture on outer side (text-fig. 1, *b*). Rostrum very short. Pronotum trapezoidal in shape, anterior margin strongly concavely sinuate, lateral margins straight, posterior margin perfectly

* A similar case of the fusion of the antennal segments is known to occur sometimes in *Ranatra kirkaldyi*, Torre-Bueno, from North America. See Hungerford, *op. cit.* p. 441, pl. xlvii. figs. 9 & 11.

straight; divided into two parts by a very distinct transverse depression situated a little less than one-third of total length above posterior margin; anterior portion conspicuously and irregularly swollen except the central area; posterior portion rather flat with a large tubercular elevation on each humeral angle. Scutellum triangular, very short, much shorter than broad. Prosternum broadly swollen. Hemelytra with membranes very reduced, slightly overlapping each other, lateral (costal) margins slightly rounded postero-laterally. Hind wings strongly reduced in size, not functional, not folded, only reaching the penultimate dorsal abdominal segment. Legs rather short, stouter than in *cinerea*, anterior femur enormously incrassate, longer than breadth of pronotum, inner groove, in which the anterior tibia fits, very

Text-fig. 1.

Antenna of *Nepa*-species.

a, *Nepa cinerea*, Linné; *b*, *Nepa dollfusi*, sp. n.; *c*, *Nepa apiculata*, Uhler; *d*, *Nepa hoffmanni*, Esaki; *e*, *Nepa primitiva*, Montandon; *f*, *Nepa seurati*, Bergevin.

broad. Female genital plate narrow, pointed at the apex. Anal appendages shorter than one-third of the length of body.

Length of body, ♀, 17 mm., breadth of body 7 mm.; breadth across the humeral angles of pronotum 5.5 mm.; length of anal appendages 4.5 mm.

Hab. Morocco.

Holotype ♀, "Oued Djenanimès près Khénifra," Morocco, June 12, 1926 (*R. P. L. Dollfus*), collected in water of 15° C. in temperature. (Colonial Laboratory of the National Museum of Natural History, Paris.)

This species is named in honour of Dr. R. P. L. Dollfus of Paris, to whom I am much indebted for many favours.

This interesting new form is superficially not very different from the common *Nepa cinerea*, Linné, but in reality it is very distinct from the latter in many respects:—

1. Hind wings dark grey and dorsal surface of abdomen dark brown; there is no trace of red coloration, which is very conspicuous in *cinerea*.

2. Head comparatively larger.

3. The second and third antennal segments fused, no lateral prolongation on the second segment.

4. Anterior portion of pronotum more strongly swollen, posterior portion of the same flat with prominent humeral tubercles; posterior margin of pronotum perfectly straight, whereas in *cinerea* it is slightly concavely sinuate.

5. Scutellum much shorter.

6. Membrane strongly reduced in size, only partly overlapping the other; in the latter one membrane totally overlaps the other.

7. Hind wings strongly reduced in size, not functional, not folded, only reaching the penultimate dorsal abdominal segment.

8. Legs stouter.

9. Anal appendages considerably shorter.

The reduced structure of the antennæ, hemielytra, and of the hind wings, as well as the very developed anterior femora, show that the insect may be more adapted to life in water than other forms of the group.

3. *Nepa hoffmanni*, Esaki. (Text-fig. 1, *d*; Pl. XV. fig. 11.)

Nepa hoffmanni, Esaki, Entom. Mitt., Berlin-Dahlem, xiv. p. 313, fig. 2 (1925).

In the original description of this species the antenna was not described. The antenna is similar to that of *Nepa apiculata*, Uhler (text-fig. 1, *c*), from North America, in wanting the lateral prolongation on the second segment, as described below.

Antennæ dark brown, three-segmented, first segment short, about twice as long as broad, second shorter than first, nearly oval in shape, third much the longest, about three times as long as broad, a little tapering near the apex (text-fig. 1, *d*).

The male is still unknown to me.

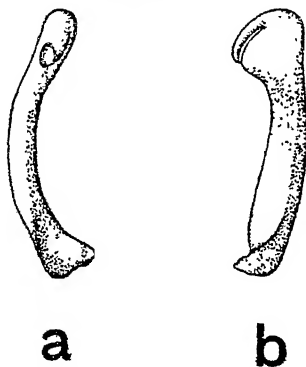
This species was described from Tsingtau, North China. Prof. H. B. Hungerford informs me that he has obtained a pair of this species from Pekin, and three females from Shantung, North China, are present in the collection of the British Museum, London.

4. *Nepa primitiva*, Montandon.
(Text-figs. 1, e, 2 ; Pl. XV. figs. 12 & 13.)

Nepa primitiva, Montandon, Bull. Acad. Roumanie, Bucarest, i. p. 314 (1913).

This species was described from Bussu Busoga, Uganda, by Montandon. The type (1 ♀) and another male specimen from the same source are now preserved in the Civil Museum of Natural History in Genoa. I have also found additional material of this species from the "Urwälder" Beni, Moera, and Mawambi, East Belgian Congo (Natural History Museum, Vienna), and from the Maramas District, British East Africa (British Museum, London). Judging by these localities the species may be distributed over tropical East Africa.

Text-fig. 2.



Left-hand paramere of *Nepa primitiva*, Montandon.
a, ventral view ; *b*, lateral view, seen from the inner side.

This small form of *Nepa* is only representative of the genus in the tropical regions, and it is easily distinguishable from the other species of the genus. This species was hitherto rather poorly known, and I therefore give the following re-description :—

Dark brown, sometimes blackish brown, dorsal surface of abdomen velvety black. Legs with more or less obscure pale patterns on femora and tibiae, antennae dark brown. Body elongate, elliptical, scarcely widened posteriorly. Head very small, longer than broad between eyes, concave on dorsal surface with an irregular longitudinal ridge along the median longitudinal line, which is sometimes broken into two small tubercles ; the posterior margin strongly convexly sinuate posteriorly, much elevated, forming a

marginal ridge. Eyes oval and strongly convex above. Antennæ three-segmented, first segment very short, slightly longer than broad, second segment strongly prolonged laterally, setose on posterior margin, third segment very long and slender, prolonged parallel to the lateral prolongation of the second segment, with which it forms a fork-like shape, setose on posterior margin (text-fig. 1, *e*). Rostrum short. Pronotum trapezoidal in shape, anterior margin strongly concavely sinuate at the middle, lateral margins shallowly but distinctly concavely sinuate, posterior margin distinctly concavely sinuate, postero-lateral angles much rounded; sculpture on pronotum rather obscure, with a large, anteriorly rather bifurcated, irregular elevation in the middle. Scutellum triangular, anterior margin convexly sinuate, lateral margins slightly waving; with a large, rather ψ -shaped, low elevation at the middle. Prosternum without tubercles. Hemelytra well-developed, completely covering the abdomen; membrane complete, coarsely reticulate. Hind wings well-developed. Legs short, rather slender, anterior femur moderately incrassate, shorter than the breadth of pronotum. Male genital plate narrow, moderately convex, female genital plate more strongly pointed. Parameres rather short, strongly curved interiorly (seen dorso-ventrally), apical portion much widened, split into a claw-like tooth (see text-fig. 2).

Length of body, ♂ 15–15.5 mm., ♀ 17–17.5 mm.; breadth of body, ♂ 5.7 mm., ♀ 7 mm.; breadth across the humeral angles of pronotum, ♂ 5.3 mm., ♀ 6.3–6.5 mm.; length of anal appendages, ♂ 3.5 mm., ♀ 4 mm.; length of anterior femur, ♂ 4 mm., ♀ 5 mm.

Hab. East Tropical Africa.

This description is made from 2 ♂♂ and 2 ♀♀ specimens from East Belgian Congo, collected in October 1910 at three different localities (Beni, Moera, and Mawambi) by Grauer, in the Natural History Museum, Vienna.

This species is quite distinct from any other known species of the genus in the remarkable structure of its antennæ, pronotum, and male genital appendages.

5. *Nepa seurati*, Bergevin. (Text-fig. 1, *f*; Pl. XV. fig. 14.)

Nepa seurati, Bergevin, Bull. Soc. Nat. Hist. Afriq. Nord, xvii. p. 293, fig. 1 (1926).

I have had an opportunity to examine a topotypical female specimen of this species, determined and presented by Bergevin to the British Museum. I herewith supplement

some notes on this interesting species to the description of Bergevin :—

The colour is blackish brown, which is much darker than in *cinerea*. Much smaller in size, more slender in shape. Underside of body also much blacker. Coxæ, trochanters, and basal half of femora of intermediate and posterior legs light brown. Dorsal surface of abdomen blackish brown. Antennæ three-segmented, similar to those of *cinerea* in respect of the lateral prolongation of the second segment; first segment a little longer than broad, the prolongation of the second segment not passing the middle of the third, third comparatively longer than in *cinerea* (text-fig. 1, *a, f*). Anterior femora strongly incrassate, but in the figure given by Bergevin they are a little exaggerated. Other legs very slender. Pronotum transverse, not so long as is shown in Bergevin's figure, in which it looks like that of a *Laccotrephes*-species.

The specimen which I examined is much larger than the type owing to the sexual difference :—

	♂ (after Bergevin).	♀.
Length of body	"10.5 mm."	14 mm.
Breadth of body	"5.4 mm."	5.3 mm.
Length of anal appendages	—	8 mm.

This is the most distinct species of the genus, owing to the very dark coloration, small size, and oblong shape of body. It is very remotely related to *Nepa cinerea*, Linné, var. *minor*, Puton, although when first described it was compared with that species.

EXPLANATION OF PLATE XV.

- Fig. 1. *Nepa cinerea*, Linné, ♀, Germany.
 Fig. 2. *Nepa cinerea*, Linné, var. *minor*, Puton, ♀, Morocco.
 Fig. 3. } *Nepa cinerea*, Linné, var. *major*, Bergevin, ♀, Morocco.
 Fig. 4. }
 Fig. 5. *The same, Gibraltar.
 Fig. 6. }
 Fig. 7. } *Nepa cinerea*, Linné, var. *orientalis*, Esaki, ♀, Amur, types.
 Fig. 8. }
 Fig. 9. *Nepa dollfusi*, Esaki, ♀, Morocco, type.
 Fig. 10. *Nepa apiculata*, Uhler, ♂, U.S.A.
 Fig. 11. **Nepa hoffmanni*, Esaki, ♀, N. China.
 Fig. 12. **Nepa primitiva*, Montandon, ♂, Belgian Congo.
 Fig. 13. *Nepa primitiva*, Montandon, ♀, British E. Africa.
 Fig. 14. *Nepa seurati*, Bergevin, ♀, Tunis.

* The anal appendages are broken in the specimen.

LVII.—*Neuroptera and Embiidina from Abyssinia and Somaliland.* By P. ESBEN-PETERSEN (Silkeborg, Denmark).

[Plate XVI.]

THE greater part of the material dealt with in this paper was collected by Dr. Hugh Scott and Mr. J. Omer Cooper during their expedition to Abyssinia, September 1926 to January 1927; but certain Abyssinian Neuroptera belonging to the British Museum, and collected during the years 1914–15 by the late O. Kovacs, Mr. R. J. Stordy, and Miss E. M. Godman, are also incorporated.

The first set of all the material, including the TYPES of the new species, will be preserved in the British Museum.

NEUROPTERA.

Ascalaphidæ.

1. Ascalaphid larva, sp. incert.

A small series of newly-hatched larvæ of an undetermined Ascalaphid was collected at the Muger River, ca. 5500 feet, 28. xii. 1926 (*Scott*). They were beaten from low bushes in the river-bed.

This larva is quite unlike any that I have seen before. The head is very large and quadrangular; the mandibles are long and provided with three large and several small teeth on the inner side. The large and very prominent ocular tubercles are placed at the front angles of the head. Prothorax half as broad as head. Abdomen flat, longer than broad; each segment (with the exception of the apical segment) provided on either side with a rather long process fringed with hairs; apical segment narrow and long. Gravely and Mauлик, in "Notes on the Development of some Indian Ascalaphidæ and Myrmeleonidæ" (*Rec. Ind. Mus.* vi, pp. 101–110, pl. v. 1911), mention a *Pseudoptynæ* larva which lives upon tree-trunks in hollows of the bark, a habit previously quite unknown in Ascalaphid larvæ. Dr. Scott's discovery of these larvæ in bushes is very interesting, and it is possible that the Abyssinian species lives in the larval stage under circumstances similar to those of the Indian species. In "Voy. Alluaud et Jeannel Afr. Orient., Névropt.," pp. 10–11, 1914, Navás mentions and figures a larva from Nairobi, which is very like that from Abyssinia, but does not mention the habitat in which it lives.

Myrmeleonidæ.

2. *Palpares papilionoides*, Klug, Symbolæ etc. iv. tab. xxxv. fig. 2. 1834 (Arabia).

Palpares interioris, Kolbe, Deutsch-Ost-Afrika, iv., Neuroptera, p. 9, 1897 (Zanzibar).

Palpares tristis, var. *ugandanus*, Stitz, Mitt. Zool. Mus. Berl. vi. p. 104, 1912 (Uganda).

1 ♂ (in alcohol), Hawash Railway Station, about 3500 feet, at light, 2. ix. 1926 (*Omer Cooper*).

Since this species seems to be very scarce, and some misunderstandings as to its synonymy have occurred, it is redescribed below.

Face yellowish; palpi black with pale articulations; labial palpi very long and slender; antennæ black and short; points of insertion of antennæ and first antennal segment yellow; between the eyes a blackish transverse band, enclosing the points of insertion of the antennæ. Vertex somewhat raised, yellowish, with a longitudinal median black streak, which meets a narrow transversely placed black streak above the antennæ. Thorax yellowish, covered with yellowish-white pile, with three longitudinal blackish streaks dorsally, and blackish spots ventrally. Abdomen brownish-yellow dorsally, with three longitudinal dark brown streaks; venter brown, becoming blackish towards apex; in the female sex the apical part of the abdomen is mostly blackish dorsally. Basal part of abdomen with rather long whitish hairs mingled with short dark bristles on the third to fifth segments; apical part of abdomen with shorter blackish hairs. Anal appendages of male as long as 8th and 9th segments together, curved, blackish, with black hairs on the outer side and short blackish bristles on the inner. Legs yellowish; a streak on the under side of the femora and tibiæ blackish-brown; tarsi and tips of tibiæ black. Wings rather broad and short, with almost rounded tips; membrane hyaline, faintly tinged with yellow, and with sooty-brown markings, which are tessellate in the fore wings and sometimes also in the hind wings. Fore wings with numerous small brown spots along the margins and at the base.

P. papilionoides somewhat resembles *P. tristis*, Hagen, but the last-named species has longer and narrower wings, longer antennæ and shorter labial palpi; its abdomen lacks the three longitudinal streaks on the dorsum, and the anal appendages of the male are longer, although similar in structure.

The centre of distribution of *P. papilionoides* seems to lie in the countries round the Gulf of Aden and the Southern part of the Red Sea.

3. *Creoleon mortifer*, Walker, List Neur. Ins. in coll. Brit. Mus. p. 353, 1853 (*Myrmeleon*) (Natal).

1 ♂, Dire Dawa, 18. ii. 1914 (*Kovacs*).

This species is widely spread in East Africa, and was previously known to occur in Abyssinia.

4. *Creoleon nubifer*, Kolbe, Deutsch-Ost-Afrika, iv., Neuroptera, p. 25, 1897 (Zanzibar, Muansa, Kinjawanga).

1 ♂, 1 ♀, Makki River, N.W. of Lake Zwai, about 6000 feet, 1. xi. 1926 (*Scott*); 1 ♂, between Lake Zwai and Makki River, ca. 5500–6000 feet, 23–24. xi. 1926 (*Omer Cooper*).

5. *Gymnoleon exilis*, Banks, Ann. Ent. Soc. Amer. iv. p. 13, 1911 (Eritrea, Lindi).

12 specimens, Tinnish Fafati, 25. xi. 1914 (*Kovacs*).

This species seems to be not uncommon in Abyssinia, and I have seen specimens of it from that country before.

6. *Nocaldria signata*, Navás, Ann. Mus. Genova, xlvii. p. 363, fig. 3, 1917 (Ethiopia). (Pl. XVI. fig. 1.)

1 specimen (tip of abdomen lost), Hawash River, 28. xi. 1914 (*Kovacs*).

This species seems to be very scarce and, since it is at present the only known representative of its genus, it is desirable to add the following notes :—

Legs rather stout; front tibiae a little shorter than front femora; hind tibiae a little longer than hind femora; tarsi as long as tibiae; first tarsal segment long, but shorter than second, third, and fourth segments united; fifth segment in front legs a little longer than basal segment, in hind legs as long as basal segment. Spurs of front legs a little shorter than basal tarsal segment, of intermediate legs half as long as basal segment; in the specimen before me no spurs are visible on the hind legs. No cross-veins in apical area of the wings. Basal free part of Cu_2 in the fore wing very feeble, and running parallel with and close to 1 A as far as the first cross-vein emitted from Cu_1 . 2 A unforked and touching 3 A at a point near the base.

7. *Macronemurus perlatus*, Gerstaecker, Mitth. naturw. Ver. Neu-Vorp. u. Rüg. xvi. p. 14, 1884 (Transvaal).

1 ♀, near N.E. shore of Lake Zwai, 4. xi. 1926 (*Scott*).

8. *Macronemurus pulchellus*, Banks, Ann. Ent. Soc. Amer. iv. p. 26, 1911 (Eritrea).

1 specimen (in alcohol), Hawash Railway Station, about 3500 feet, at light, 2. ix. 1926 (*Omer Cooper*).

A very rare species, of which, besides this specimen, I only know the type, which is in my collection.

9. *Nesoleon variegatus*, Klug, Symbolæ etc. iv. tab. xxxv. fig. 4, 1834 (Arabia).

1 ♂, 1 ♀ (in alcohol), Hawash Railway Station, about 3500 feet, at light, 2. ix. 1926 (*Omer Cooper*).

This species was previously known to occur in Abyssinia.

10. *Nesoleon tumidus*, Banks, Journ. N. York Ent. Soc. xxi. p. 156, 1913 (Harar, Abyssinia).

6 specimens (in alcohol), Hawash Railway Station, about 3500 feet, at light, 2. ix. 1926 (*Omer Cooper*).

This species is only known from specimens from Abyssinia.

11. *Myrmeleon furcatus*, Banks, Ann. Ent. Soc. Amer. iv. p. 11, 1911 (Eritrea).

1 ♂, 1 ♀, Jem-Jem, 6. x. 1926 (*Scott*), beaten from the thatch of a hayrick in the afternoon; 1 ♂, Marako, 7. v. 1915, and 1 ♀, same locality, 30. ix. 1915 (*Kovacs*).

Chrysopidæ.

12. *Nothochrysa variegata*, Burmeister, Handbuch, ii. p. 981, 1839 (Comoro Islands).

Chrysopa mozambica, Walker, Trans. Ent. Soc. Lond. p. 199, 1860 (Mozambique).

Chrysopa rufostigma, MacLachlan, Journ. Linn. Soc. Lond. ix. p. 253, 1868 (Natal).

Nothochrysa sordidata, Navás, Mem. Real Acad. Barcel. vi. p. 404, 1908 (Madagascar).

Nothochrysa unpar, Navás, Broteria, x. p. 99, 1912 (South Africa).

Nothochrysa maculata, Esben-Petersen, Ent. Mitt. i. p. 270, 1912 (Transvaal).

Nothochrysa zonata, Navás, Ann. Soc. scient. Brux. xxxvii. p. 324, 1913 (Abyssinia).

1 specimen, Abyssinia, 1912 (*Stordy*).

This species has a wide range in Africa, and is very liable to vary. I have seen examples from Abyssinia, Eritrea, Transvaal, the Cape, Lorenzo Marques, and Caffraria.

13. *Chrysopa vulgaris*, Schneider, Symbolæ ad Mon. gen. Chrysopæ Leach, p. 68, tab. viii. (1851).

1 specimen, Berbera, British Somaliland, 27. xii. 1919 (Miss E. M. Godman).

This common and widely distributed species is known to occur in several localities in Africa.

14. *Chrysopa umbrosa*, Navás, Voyage Allnaud et Jeannel Afr. Orient. no. 24, Névropt., p. 34, fig. 15, 1914 (British East Africa).

3 specimens, Marako, Central Abyssinia, viii.-ix. 1914 (Kovacs).

15. *Chrysopa congrua*, Walker, List Neur. Ins. in coll. Brit. Mus. p. 238, 1853 (West Africa). (Pl. XVI. fig. 2.)

Chrysopa concolor, Walker, loc. cit. p. 239 (Congo); MacLachlan, Journ. Linn. Soc. Lond. ix. p. 268, 1867.

Chrysopa bequaerti, Navás, Revue Zool. Afr. i. p. 409, fig. 4, 1912 (Belgian Congo).

8 specimens (in alcohol), Ambouli Oasis, Jibuti, French Somaliland, 29. i. 1927 (Scott); 20 specimens, Marako, Central Abyssinia, viii.-ix. 1914 (Kovacs).

For several years this species has given me much trouble. In my own collection I possess about twenty specimens from Abyssinia and several from other parts of Africa. In 1912 Navás described the species under the name *C. bequaerti*, which I have always supposed to be a synonym of Walker's *C. congrua*, though I have never been able to identify the latter from the description. With the assistance of Mr. D. E. Kinnings, who has very carefully compared material and photographs with the types of *C. congrua* and *C. concolor* in the British Museum, I am now convinced that this widespread species is *Chrysopa congrua*. It is very like the common *C. vulgaris*, Schneid., but is more slender, its wings are narrower and more pointed at the apex, and the hairs on the veins are shorter. Below each eye is a faint reddish spot or streak; the apical segment of the palpi is as a rule slightly reddish at the tip. It is probable that other African species of the *vulgaris*-group will prove to be identical with *C. congrua*.

Hemerobiidæ.

16. *Micromus africanus*, v. d. Weele, Sjöstedt's Kilimandjaro-Meru Expedition, Neuroptera, ii. part 13, p. 17, 1909. (Pl. XVI. fig. 3.)

10 specimens, Jem-Jem Forest, 8000-9000 feet, from foliage of *Podocarpus gracilior*, 21. ix. and 10. x. 1926 (Scott).

An extremely interesting species, also very liable to vary. Not until I had photographs of specimens compared with the type-series in the Stockholm Museum was I able to identify the present material as belonging to the species of van der Weele. Amongst the material there are hardly two specimens quite alike. The obliquely placed dark streak at the tip of the wings and the dark cross-veins of the outer gradate series in the fore wing are, however, common characters for most forms. The variety with strongly-marked wings, figured on Pl. XVI., stands nearest the typical form.

17. *Hemerobius abyssinicus*, sp. n. (Pl. XVI. fig. 4.)

Head brownish-yellow, a brown shining spot on the gena below each eye. Palpi yellowish; apical segment of maxillary palpi long and strongly pointed. Antennæ shorter than fore wings, brownish-yellow, slightly darker towards apex, and faintly ringed with yellowish. Thorax dark brown, and with a longitudinal median yellowish streak dorsally; venter pale yellowish; sides tinged with pale grey. Legs pale yellowish; claws dark brown. Abdomen pale brown. Head, body, and legs with long pale hairs. Venation of the wings yellowish; the longitudinal veins and the costal cross-veins of the fore wings with short dark brown streaks, which are all strongly shaded with greyish; the rest of cross-veins in the fore wing dark brown and broadly shaded, whereby three obliquely placed bands are formed, one along each of the series of gradate cross-veins and one along the apical margin; the posterior margin of the fore wing is also broadly shaded. In the hind wings the cross-veins are pale brown.

Fore wing 8 mm.; hind wing 6.7 mm.

2 ♀, Mt. Zukwála, highest point, ca. 9600 feet, 22. x. 1926 (Scott).

Owing to its strongly shaded fore wings, *Hemerobius abyssinicus* somewhat resembles *H. reconditus*, Navás (Voy. Alluaud et Jeannel Afr. Orient., Névroptères, i. p. 29, fig. 12, 1914), of British East Africa, but it is easily distinguished

from that species by the unmarked basal segments of the antennæ and by the presence of four radial sectors in the fore wing. In the new species the inner series of gradate cross-veins is also placed nearer the apex of the wing than in *H. reconditus*.

Mantispidæ.

18. *Mantispa* (*Mantispilla*) *lineatifrons*, Enderlein, Stettin. entom. Zeit. lxxi. p. 346, 1910 (Eritrea).

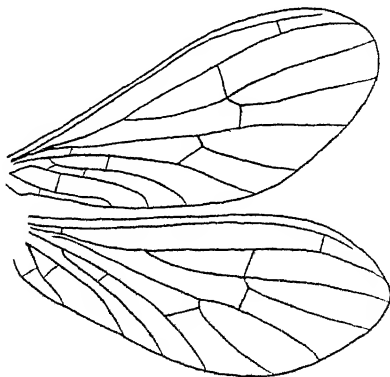
6 specimens, Jem-Jem Forest, ca. 9000 feet, beaten from foliage of *Juniperus procera*, 4. x. 1926 (Scott).

Coniopterygidæ.

19. *Semidalis scotti*, sp. n.

Head brown and shining; thorax blackish-brown, shining; abdomen reddish; legs pale testaceous. Antennæ rather long, but shorter than the fore wing, with 35 segments; pale

Text-fig. 1.



Semidalis scotti, sp. n.

testaceous, becoming darker towards apex; most of the antennal segments about $1\frac{1}{4}$ as long as broad. First tarsal segment a little longer than second to fifth segments taken together. Wings densely covered with white waxy powder. *Sc*, *R*, and *Cu*₁ in both pairs of wings blackish; remaining veins only a little darker than membrane; cross-vein between *R* and *Rs* touching last-named vein at its fork. Marginal setæ inconspicuous.

Length of fore wing 4 mm.

1 ♂, Mt. Chillálo, ca. 9000 feet, 12. xi. 1926 (Scott).

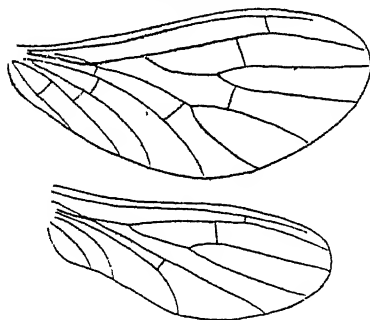
This species resembles the European *Semidalis aleurodi-formis*, but I think it will prove to be distinct and valid. The shape of its wings, the dark head and thorax, and the dark apical part of its antennæ are useful characters for purposes of discrimination.

The following species of the genus are known to occur in Africa: *Semidalis africanus*, Enderl. (Tanganyika and Seychelles), *S. fülleborni*, Enderl. (Tanganyika), and *S. fuscicornis*, Navás (Kenya Colony).

20. *Coniopteryx crassicornis*, sp. n.

Head testaceous; meso- and metathorax dark; abdomen reddish-yellow, its tip dark. Legs testaceous. Antennæ testaceous, short and very thick, half as long as the fore wing, with 29 segments, clothed with coarse hair; basal

Text-fig. 2.



Coniopteryx crassicornis, sp. n.

antennal segment stout, second narrower, half as long again as broad; following segments twice as broad as long, the 5 to 6 apical segments narrowing towards the tip of the antennæ, apical segment longer than broad, penultimate segment as long as broad. Wings densely covered with white waxy powder; *Sc* and *R* in both pairs of wings dark; remainder of veins only a little darker than membrane.

Length of fore wing 3.5 mm.; that of hind wing 3 mm.

1 ♂, Jem-Jem Forest, 8000–9000 feet, 21–29. ix. 1926 (*Scott*).

This peculiar species is easily recognisable by its short and thick antennæ. In the hind wing there is no cross-vein between the posterior branch of subradial fork and *M*.

21. *Coniopteryx aegyptiaca*, Withycombe, Bull. Soc. R. Entom. d'Egypte, 1923, p. 146, figs. 6-8, 1924 (Wadi Digla, near Cairo).

2 ♀, Jem-Jem Forest, ca. 8000 feet, 9. x. 1926 (*Scott*).

It is with some hesitation that I refer these two specimens to the above-named species, on account of their pale abdomens, since Withycombe did not know the female sex. In all other respects the two specimens agree very well with the description and figures given of *C. aegyptiaca*.

EMBIIDINA.

Amongst the material brought home from Abyssinia, specimens of two species of the above-named Order were present, viz., one female and ten specimens in the larval stage. Since it is very difficult and almost impossible to determine such material, it is with some hesitation that I refer the material to the following species:—

1. *Embia collariger*, Enderlein, Zool. Anz. xxxv. p. 182, 1909; id., Embiidinen, Coll. Zool. Selys-Longchamps, fascic. 3, p. 41, fig. 17, 1912 (Eritrea).

1 ♀, beaten from a tree encrusted with lichens in the Lagalafto Ravine, between the Hawash River and Lake Zwai, ca. 6000 feet, 31. x. 1926 (*Scott*).

2. *Oligotoma saundersi*, Westwood, Trans. Linn. Soc. Lond. xvii. p. 373, 1837 (Bengal).

1 ♂, 9 ♀ (larvæ), Mt. Zukwála, ca. 9000 feet, beaten from branches of trees, covered with hanging lichens, by the lake, 22. x. 1926 (*Scott*).

[NOTE.—I had previously found Embiidina living in trees in the Seychelles, where a species of *Oligotoma* made its web-tunnels on patches of moss on the trunks of small trees in the endemic forests: see Scott, Trans. Linn. Soc. London, ser. 2 (Zool.), xiv. pp. 30, 31, 1910; and Enderlein, *t. c.* pp. 55, 56, 1910.—HUGH SCOTT.]

EXPLANATION OF PLATE XVI.

Fig. 1. *Nocaldria signata*, Navás.

Fig. 2. *Chrysopa congrua*, Walker.

Fig. 3. *Micromus africanus*, v. d. Weele.

Fig. 4. *Hemerobius abyssinicus*, sp. n.

LVIII.—*A Comparative Study of the Otoliths of the Neopterygian Fishes* (continued). By G. ALLAN FROST.

[Plate XVII.]

XVIII. Order PERCOMORPHI (*cont.*).

Suborder PERCOIDEA (part 2).

Division CIRRHITIFORMES.

In *Chironemus marmoratus* (Pl. XVII. fig. 1) (fam. Chironemidæ) the sagitta resembles that of *Perca* generally; it differs in the low regular dorsal rim, in the absence of an antirostrum and in the shallow excisura, also in the cauda, in which the usually narrow anterior part is wide and depressed.

Division DITREMIFORMES.

The sagitta of *Ditrema temminckii* (Pl. XVII. fig. 2) (fam. Ditremidæ) resembles that of *Drepane* of the division Perciformes; it differs in the large curved excisura, in the concavity of the upper margin and wide opening of the ostium, and in the hollow depression in the dorsal area.

Division POMACENTRIFORMES.

In *Chromis chromis* (Pl. XVII. fig. 3) (fam. Pomacentridæ) the otolith is of the Percid type; it differs from *Perca* in the depth of the ventral rim, in the downward inclination of the ostium, in the absence of an angle of the sulcus, and in the width of the cauda.

In *Hypsypops rubicundus* (Pl. XVII. fig. 20) (fam. Pomacentridæ) the otolith is of the Percid type; it differs in the presence of a large incurved excisura. A long narrow rostrum is present upon which the ostium does not extend; the antirostrum is acutely pointed. The ostium is short, and the cauda is broad, with the end downcurved and rounded. There are depressions above and below the sulcus.

Division EMBIOTOCIFORMES.

In *Embiotoca jacksoni* (Pl. XVII. fig. 18) (fam. Embiotocidæ) the sagitta is wedge-shaped and is heavily curved in its length. It resembles that of *Perca* generally, but differs in the large rostrum, in the absence of an antirostrum and excisura, and in the oblique sulcus. The anterior part of the

ostium is occupied by a semi-ovate colliculum ; there are two angles of the lower margin of the sulcus ; the anterior part of the cauda is regular, and the end is nearly circular. The ventral rim of the otolith has a slight median angle, behind which there is a concavity.

Division LABRIFORMES.

The otoliths of this division are specialized, and differ from the Percid type ; exceptions are those of *Inistius* and *Parapercis*.

Those of *Labrus mixtus* (Pl. XVII. fig. 4) (fam. Labridæ) are the most generalized, and may be taken as characteristic of the "Labrid" type. The shape is sagittiform, the outer side is flat, and the inner side is convex. The dorsal rim is domed and regular, the ventral rim is curved, the posterior rim is pointed, and the anterior rim consists of a narrow obtuse rostrum, a slightly shorter but prominent antirostrum, and a deep acute excisura. There is a median rounded upward extension of the ventral area, dividing the excisura from the cauda ; this extends very slightly on to the dorsal area, resembling the hinge of a bivalve. There is no ostium, owing to the size of the excisura ; the cauda is ovate, distended, shallow behind, and is bounded by the posterior rim of the otolith.

In *Cheilinus fasciatus* (Pl. XVII. fig. 5) (fam. Labridæ) the sagitta resembles that of *Labrus*. It differs in the width of the posterior part of the otolith, in the broader rostrum, in the presence of an ostium, in the small round-ended excisura, and in a straight anterior part of the cauda, which forms two angles in the lower margin of the sulcus.

The otolith of *Epibulus insidiator* (Pl. XVII. fig. 6) (fam. Labridæ) resembles that of *Cheilinus* ; it differs in the dorsal rim, which is high and pointed in its anterior part, and also forms an angle with the posterior rim ; it also differs in the upper margin of the sulcus, which curves abruptly upwards, forming an angle above the cauda, which is shallow and depressed.

In *Lachnolaimus falcatus* (Pl. XVII. fig. 7) (fam. Labridæ) the otolith resembles that of *Labrus* ; it differs in its attenuated shape, in the acute narrow rostrum, the irregular antirostrum, and in the upward curve of the upper margin of the sulcus, in which it resembles *Epibulus*.

In *Julis lunaris* (Pl. XVII. fig. 8) (fam. Labridæ) the shape is rectangular, the dorsal rim is horizontal and slightly concave, and forms a rounded angle with the posterior rim, which is vertical. The anterior rim resembles that of

Cheilinus in the round-ended excisura, but differs in the more elevated antirostrum. The sulcus resembles those of the division Perciformes; there is a shallow ostium and a broad curved cauda which ends against the posterior rim.

In *Iniistius niger* (Pl. XVII. fig. 9) (fam. Labridæ) an aberrant form occurs. The shape is circular, the outer side is flat and the inner side is concave, and the rims are dentated. The rostrum and antirostrum are slight and rounded, and there is a small excisura. The sulcus is broad and straight, extending a short distance only beyond the middle of the face of the otolith. This form shows no resemblance to those examined of other genera of the Labridæ, but in *Iniistius dea* the otolith is practically identical.

The otoliths of the family Scaridæ are of the Labrid type, differing, in those species examined, in the greater depth and more rectangular shape.

The otolith of *Scarus abildgaardii* (Pl. XVII. fig. 10) resembles that of *Labrus* in its general shape and in the hinged appearance of the inner side. It differs in the irregular dorsal rim, in the oblong shape, in the small hooked antirostrum, and in the upturned round-ended excisura, which resembles that of *Cheilinus*. The ventral rim is irregular and serrated, and the lower part of the otolith is lightly furrowed. The upper margin of the cauda has an abrupt upward curve, as in *Epibulus*. The otoliths of *Scarus catesbyi* and of *Pseudoscarus cæruleus* resemble those of the above-described species.

In certain species of the family Scaridæ—e. g., *Scarus squalidus*, *Pseudoscarus viridis*, and *P. guacamaia*—the anterior rim of the otolith is modified, a specialized feature being the antero-dorsal position of the excisura.

In *Pseudoscarus viridus* (Pl. XVII. fig. 16) the sagitta resembles generally that of *Scarus abildgaardii*. It differs in the symmetrical shape and in the regularity of the dorsal and ventral rims. The dorsal rim is domed, passing into the posterior rim, and the ventral rim is regular and serrated. The dorsal and ventral areas are both lightly furrowed. The anterior rim is pointed and has a small indentation below the point; the upper part is oblique, passing into the dorsal rim. At the junction with the dorsal rim a narrow acutely pointed excisura descends within the ostium, which is small and sharply upturned, and is connected by a narrow groove with the cauda, which is shallow and has a marked angle of the lower margin.

Division AMMODYTIFORMES.

In *Ammodytes tobianus* (Pl. XVII. fig. 11) (fam. Ammodytidae) the shape is amygdaloidal and biconvex. The dorsal rim is irregular and highest anteriorly, the posterior rim is pointed, the ventral rim is curved and regular, and the anterior rim is rounded and oblique in its upper part and forms a rounded angle with the dorsal rim; there is no rostrum, antirostrum, or excisura, and a sulcus was indiscernible in the examples examined.

Division TRACHINIFORMES.

In *Trachinus draco* (Pl. XVII. fig. 13) (fam. Trachinidae) the sagitta is elongated, pointed anteriorly, and oblique posteriorly. The outer side is concave and the inner side is convex and smooth. The dorsal rim is low and curved and forms an angle with the posterior rim, which is oblique. The ventral rim is curved and regular, and the angle with the posterior rim is slightly acute. The anterior rim consists of a narrow rostrum, no antirostrum or excisura being present. The sulcus is undivided and opens on the hinder part of the rostrum. It is undivided, uniform in width, and sigmoidal. The ostium descends from the opening on the rostrum and rises again to the cauda, which is upwardly inclined and terminates with rounded end below the dorsal rim.

In *Uranoscopus scaber* (Pl. XVII. fig. 14) (fam. Uranoscopidae) the otolith is subovate and biconvex. The inner side is lightly furrowed in its dorsal and ventral parts. The dorsal and ventral rims are curved and meet posteriorly in a rounded point. Anteriorly there is a short rostrum, but no antirostrum or excisura is present. The sulcus is enclosed and undivided, and the upper margin is ill-defined and sloping.

In *Paraperca colias* (Pl. XVII. fig. 12) (fam. Pinguipedidae), also of this division, the otolith is of the Percid type and resembles in general features that of *Perca*. It differs in the prolongation of the posterior rim, which forms a narrow round-ended process, in the ventral rim, which is deepest anteriorly, and in the sharply pointed end of the cauda.

Division NOTOTHENIIFORMES.

In *Notothenia macrocephala* (Pl. XVII. fig. 15) (fam. Nototheniidae) the sagitta is of the Labrid type, and resembles that of *Scarus abildgaardii* in general features. It differs in

the anterior rim, in which the large rostrum and excisura resemble those of *Labrus*, and in the antirostrum, which is heavy and coarsely rounded. It also differs in the posterior rim, which is truncated, and has an indentation of the lower part. An ostial area is present above the rostrum; the sulcus is divided medianly, and the cauda appears constricted and is ill-defined in the examples examined.

Division CALLIONYMIFORMES.

In *Callionymus lyra* (Pl. XVII. fig. 17) (fam. Callionymidæ) the sagitta resembles in outline, except in the anterior rim, that of *Labrus*. It differs in the absence of an excisura or antirostrum, and in the sulcus, which resembles that of *Uranoscopus*, from which, however, it differs in the opening on the rostrum, in the greater upward inclination, in the presence of an angle of the lower rim, and in the short cauda, which ends in the centre of the inner side of the otolith.

Division CHAMPSODONTIFORMES.

In *Champsodon guentheri* (Pl. XVII. fig. 19) (fam. Champsodontidæ) the sagitta is flat on both sides, the dorsal rim is high and irregular, the ventral rim is irregular and deepest posteriorly, the posterior rim is vertical, and the anterior rim is roughly pointed. The sulcus is enclosed, undivided, shallow, and has a median angle of the upper rim. A narrow crest is present above the sulcus, and there is a broad rounded ridge below. The anterior rim is dentated, and there is no rostrum, antirostrum, or excisura.

Division TRICHODONTIFORMES.

The otolith of *Trichodon trichodon* (Pl. XVII. fig. 21) (fam. Trichodontidæ) resembles in shape that of *Iniistius* of the division Labriformes. It differs in the outer side, which is convex and is deeply furrowed, in the anterior rim, in which the rostrum is broad and rounded, and in the absence of an antirostrum. It also differs in the sulcus, which is biovate, and has upper and lower median angles; a colliculum is present in both the ostium and the cauda.

SUMMARY.

1. In the divisions Cirrhitiformes, Ditremitiformes, Pomacentriformes, Embiotociformes, and in *Parapercis* of the division Trachiniformes the otoliths resemble those of the foregoing division Perciformes.

2. Those of the division Labriformes are specialized, the most generalized form being that of *Labrus mixtus*, distinguished by the prominent rostrum and antirostrum, the large excisura, the ovate shallow cauda, and the hinged appearance of the inner side. In some species the latter feature is absent and there is a straight anterior part to the cauda, and the excisura is smaller and rounded (e. g., *Cheilinus*). An aberrant form occurs in *Iniistius*.

3. The otoliths of the Scaridæ generally resemble those of the Labridæ, differing in their greater height and more rectangular appearance. In certain species the anterior rim is modified, and a narrow triangular excisura is present at the antero-dorsal point (e. g., *Pseudoscarus viridis*).

4. In the division Trachiniformes in those species examined the sulcus is sigmoidal, uniform in width, and is not divided, the cauda being upwardly inclined; an exception is *Parapercis*, in which the otolith is of the Percid type.

5. The otoliths of *Notothenia* are of the Labrid type.

6. In *Callionymus* the sagitta combines features of the otoliths of the Labridæ and Trachinidæ.

7. In *Trichodon* the shape resembles that of *Iniistius*, but differs in the sulcus.

EXPLANATION OF PLATE XVII.

- Fig. 1. *Chironemus marmoratus*, $\times 3$.
 Fig. 2. *Ditrema temminckii*, $\times 3$.
 Fig. 3. *Chromis chromis*, $\times 3$.
 Fig. 4. *Labrus mixtus*, $\times 3$.
 Fig. 5. *Cheilinus fasciatus*, $\times 3$.
 Fig. 6. *Epibulus insidiator*, $\times 3$.
 Fig. 7. *Lachnolaimus fulcatus*, $\times 1\frac{3}{4}$.
 Fig. 8. *Julis lunaris*, $\times 4$.
 Fig. 9. *Iniistius niger*, $\times 3$.
 Fig. 10. *Scarus abildgaardii*, $\times 3$.
 Fig. 11. *Ammodytes tobianus*, $\times 7$.
 Fig. 12. *Parapercis colias*, $\times 2\frac{1}{2}$.
 Fig. 13. *Trachinus draco*, $\times 1\frac{1}{2}$.
 Fig. 14. *Uranoscopus scaber*, $\times 1\frac{3}{4}$.
 Fig. 15. *Notothenia naoriensis*, $\times 3\frac{1}{2}$.
 Fig. 16. *Pseudoscaris viridis*, $\times 3$.
 Fig. 17. *Callionymus lyra*, $\times 4$.
 Fig. 18. *Embiotoca jacksoni*, $\times 2$.
 Fig. 19. *Champsodon guentheri*, $\times 5$.
 Fig. 20. *Hypsypops rubicundus*, $\times 2$.
 Fig. 21. *Trichodon trichodon*, $\times 6$.

LIX.—*Freshwater Copepoda and Hydrogen Ion Concentration.* By A. G. LOWNDES, M.A., F.L.S.

IN 1923 a series of observations was started in order to investigate the direct connection, if any such existed, between hydrogen ion concentration and the occurrence of freshwater Copepoda. The method employed was to obtain the pH of various pieces of fresh water directly in the field, gather the Copepoda living there at the time, and subsequently identify them. At first the work was confined to the Marlborough district and the one genus *Cyclops*, but gradually it was extended and other genera included. The pH was obtained in all cases by the indicator method, and no corrections have been made for salt-error.

Copepoda were eventually collected from the following districts:—Marlborough (including Savernake Forest), Cot-hill in Berkshire, Wicken Fen (Cambridge), Norfolk Broads, Dartmoor, Salisbury district, Folkestone, the rock-pools of the Cuillin Hills of Skye, various ponds in the Glen Cœ district, Lochs Tay, Earn, Freuchie, and the freshwater ponds etc. of Edge Island, Spitsbergen. Finally, I received some collections of plankton collected from Lake Lucerne by Mr. J. T. Saunders of Cambridge, who also gave the pH readings, and a similar collection taken from Loch Awe by Miss P. M. Jenkin, who also supplied the readings for pH. The identification of species was my own work in every case. The utmost care was taken, as the following list will show, which includes several new records for the British Isles and two that are new to science. This close attention to specific details, leading as it did to the splitting of more than one species, was considered necessary, since without it any discussion on occurrence and environment would be meaningless. The classification and nomenclature used is that of Prof. G. O. Sars in 'Crustacea of Norway.'

COPEPODA.

CALANOIDA.

	Range of pH.	Note on observations.
<i>Eurytemora raboti</i> , Richard	7.2-8.4	Local.
<i>Diaptomus gracilis</i> , Sars	4.7-8.3	Common.
— <i>castor</i> , Jurine	4.9-8.1	Common.

HARPACTICIDS.

	Range of pH.	Note on observations.
<i>Canthocamptus staphylinus</i> , Jurine	4.1-8.4	Common.
— <i>minutus</i> , Claus	5.1-7.2	Common.
<i>Attheyella crassa</i> , Sars	5.2-7.2	Common.
— <i>pygmaea</i> , Sars	3.4-7.1	Common.
— <i>trispinosus</i> , Brady	6.3-7.0	Few records.
— <i>wulmeri</i> , Kerhervé	7.8-8.2	Recently recorded.
<i>Nitocra hibernica</i> , Brady	7.2-8.3	Few records.

CYCLOPIDÆ.

<i>Cyclops abyssorum</i> , Sars	6.2-7.3	Common, but local.
— <i>americanus</i> , Marsh	7.8-8.6	Recently recorded.
— <i>bicolor</i> , Sars	7.0-7.8	Rare.
— <i>bisetosus</i> , Rehberg	5.4-8.1	Common.
— <i>crassicaudis</i> , Sars	6.2-8.7	Local.
— <i>gigas</i> , Claus	7.4-8.2	Few records.
— <i>lacuna</i> , Lowndes	6.0-8.2	Recently recorded.
— <i>longividus</i> (var. typ.), Sars	3.0-7.2	Common.
— <i>latipes</i> , Lowndes	6.5-8.2	Recently recorded.
— <i>nanus</i> , Sars	4.4-7.2	Rather rare.
— <i>pictus</i> , Koch	4.6-8.9	Common.
— <i>pulchellus</i> , Koch	4.1-8.6	Common.
— <i>robustus</i> , Sars	4.6-8.2	Common.
— <i>rubellus</i> , Lilljeborg	6.3-7.2	Rare.
— <i>varicans</i> , Sars	7.2-8.6	Rare.
— <i>venustus</i> , Norman & Scott	5.1-7.4	Local.
— <i>vicinus</i> , Uljanin	6.2-8.1	Common.
— <i>vulgaris</i> , Koch	4.6-9.8	Common.
<i>Mesocyclops crassus</i> , Fischer	7.6-8.4	Few records.
— <i>obsoletus</i> , Koch	7.2-9.8	Common.
<i>Pachycyclops annulicornis</i> , Koch	4.4-9.8	Common.
— <i>bistriatus</i> , Koch	7.6-8.4	Few records.
— <i>signatus</i> , Koch	5.0-8.1	Common.
<i>Leptocyclops agilis</i> , Koch	4.6-9.8	Common.
— <i>lilljeborgi</i> , Sars	4.6-7.6	Common.
— <i>macrurus</i> , Sars	5.4-8.6	Rare.
— <i>macruroides</i> , Lilljeborg	5.2-9.8	Common.
— <i>prasinus</i> , Fischer	4.6-9.8	Common.
— <i>speratus</i> , Lilljeborg	7.6-9.0	Rare.
<i>Platycyclops affinis</i> , Sars	4.7-7.8	Common.
— <i>fimbriatus</i> , Fischer	4.1-8.6	Common.
— <i>phaleratus</i> , Koch	7.2-8.6	Rare.

It must be noted that the remarks *common*, *local*, *recent*, etc., placed in the third column refer to my own observations only. Thus I have not found *Eurytemora raboti* or *Cyclops crassicaudis* outside Edge Island, and only recorded *Attheyella wulmeri* as late as the spring of 1927. *Nitocra hibernica* is a well-known species, but I have only come across it in two

districts. *Cyclops abyssorum* is quite a common species, but only occurs in large lakes and generally at a considerable depth. I have obtained *Cyclops gigas* from but one district, and only lately recorded both *Cyclops lacunæ* and *Cyclops latipes*, although they are widely distributed. Other species are rather rare in this country, but apparently very widely distributed and common elsewhere—in particular, *Platycyclops phaleratus* and *Cyclops varicans*. One record is rather remarkable: *Mesocyclops obsoletus* is one of the commonest species known and world-wide in its distribution, yet it has a comparatively small range of pH. The only explanation that I can put forward is that I have never found this species except in chalk or limestone districts. A set of breeding experiments would be necessary in order to show whether a low pH apart from the absence of calcium is an important factor.

There are altogether forty-three species recorded, of which twenty-four must be considered quite common, and these have a range of 3.0–9.8. No species occurs through the whole range. It must also be pointed out that, while very high and very low values are not particularly reliable, yet the ranges in question even at the extremes cannot be far out. The figure 3.0 is probably the lowest ever recorded, and I am glad that my observation was in this case confirmed by Mr. J. T. Saunders, who gave as the pH 2.95. At the other end 9.8 is the highest figure given by a buffer solution of thymol blue, this being the only suitable indicator for general purposes. The figure 9.8 should therefore be taken to mean that the reading was at least 9.8. Single records and observations, of which I have a considerable number, are not given.

Discussion of the Observations.

Although the above figures show conclusively that all the species studied have a certain range over which the pH may be altered without producing any serious effect, and that this range seems to be remarkably large in some species, it by no means proves that pH is without influence on the species in question. It is more than probable that there is a certain optimum value for each species. This value will only be obtained by carrying out a considerable number of counts of each of the species represented. It is obvious that a range must exist, when we consider that the pH of a small pond may vary considerably during a single sunny day, and

unless the Copepoda and other animals were able to withstand these fluctuations they could not survive.

Finally, one must differentiate between the direct and indirect influence of a high pH. A high pH seems to have a direct influence on certain Infusoria which may form the staple food of certain species of Copepoda. Calcium and magnesium carbonates may be present in the subsoil or in the bed of the stream that feeds the pond; subsequent photosynthesis taking place among algae will produce a very high pH. Here, then, are obviously two influences at least to be considered—namely, the possible direct toxic effect of calcium and magnesium and the actual effect of the pH itself.

Considerations of this nature led me to carry out certain experiments on the direct influence of pH. These are described more fully in 'The Natural History of Wicken Fen,' published by Messrs. Bowes and Bowes of Cambridge—consequently only brief reference is given here.

C. langvidus, Sars, was selected—a species which shows every sign of being a transitional one, and of which there are a considerable number of varieties. Adult females were taken and the eggs hatched out. The nauplii were then allowed to grow to the adult state under the widest possible variation of pH, with the result that it was found that so long as calcium and magnesium salts were not present in the water to any great extent a high pH had no apparent toxic effect. The animals bred freely, and the adults showed no alteration in structure so far as direct measurements under the microscope could show.

It will be seen that *C. langvidus* has a considerable range of pH. Adult females were therefore taken from a district with a high value and compared with those from a district with a low value. Both lots of specimens were subjected to the most careful observation and measurements, and it was found that there was no more variation between individuals taken from widely separated districts with very different pH than between those taken from one and the same pond.

Conclusion.

These experiments and observations serve to show that variation in hydrogen ion concentration can have no direct influence on *Cyclops langvidus*, and strongly suggest that its influence on other species is also small.

LX.—*Copepoda and Cladocera of the Cuillin Hills of the Isle of Skye.* By A. G. LOWNDES, M.A., F.L.S.

THE Cuillin Hills of Skye are one of the most famous places in the British Isles from a geological point of view, but little or no systematic work has been done on the freshwater pools and rock-basins that occur there so frequently.

In the summer of 1925 and 1926 a series of collections of Copepoda and Cladocera were made, and the hydrogen ion concentration or pH value was taken at the same time.

The Cladocera were identified for me by Miss P. M. Jenkin, of the Zoological Department of Birmingham University, and I take this opportunity of expressing my thanks to her.

The pools in question have the following points in common:—They are all small and shallow. They are all very exposed and have an abundant supply of rain, and hence the water is in no case stagnant. The vegetation is in most cases very scanty, and some of the pools are at considerable heights above sea-level. Calcium and magnesium carbonates in the forms of chalk, limestone, or dolomite are absent, though both calcium and magnesium are abundant in the rocks themselves. The rocks of the Glenbrittle and the Roineval districts, where the collections were made, consist of basic and ultrabasic igneous rocks, which are, of course, rich in ferro-magnesian silicates and feldspars containing a high percentage of lime, but in no case do the magnesium and calcium accumulate in the fresh water as carbonates or bicarbonates, with the result that the pH of all these pools is very low. The lowest value recorded was 4.4 and the highest 6.3.

List of Species found in Skye, together with the Range of pH.

COPEPODA.

<i>Diaptomus laciniatus</i> , Lilljeborg	5.2
<i>Attheyella pygmaea</i> , Sars	4.4
— <i>zschokkei</i> , Schmeil	4.4
<i>Cyclops pictus</i> , Koch	4.6–6.3
— <i>vulgaris</i> , Koch	4.6–6.3
— <i>nanus</i> , Sars	4.4–4.6
— <i>bisetosus</i> , Rehberg	5.8
— <i>lucidulus</i> , Koch	4.4–5.8
— <i>robustus</i> , Sars	4.6
— <i>longivulus</i> , Sars	4.4
<i>Pachycyclops annulicornis</i> , Koch	4.4–6.3

<i>Leptocyclops agilis</i> , Koch	5.0-6.3
— <i>lilljeborgi</i> , Sars	4.6-5.8
— <i>prasinus</i> , Fischer	4.6-5.8
— <i>macruroides</i> , Lilljeborg.....	5.2
— <i>macrurus</i> , Sars	5.4
<i>Platycyclops fimbriatus</i> , Fischer	6.3

CLADOCERA.

<i>Sida crystallina</i> , Müller.....	4.6-4.8
<i>Latona setifera</i> , Muller	4.6-5.2
<i>Ceriodaphnia quadrangula</i> , Müller	4.6-4.8
<i>Bosmina obtusirostris</i> , Sars	4.4-5.2
<i>Drepanothrix dentata</i> , Eurén	4.6
<i>Acantholebris curvirostris</i> , Muller	4.4-4.8
<i>Eurycercus lamellatus</i> , Müller	4.8-5.4
<i>Acroperus harpæ</i> , Baird	5.0
<i>Alonopsis elongata</i> , Sars.....	4.4-5.4
<i>Alona affinis</i> , Leydig	4.6-5.4
<i>Alonella nana</i> , Baird	4.4-5.4
— <i>excisa</i> , Fischer	4.6
<i>Chydorus latus</i> , Sars	5.4
— <i>sphaericus</i> , Müller	4.4-5.0
<i>Polyphemus pediculus</i> , Linné.....	4.6-6.3
<i>Daphnia</i> sp. (one damaged specimen).	

In a tidal pool:

<i>Mesochra lilljeborgi</i>	8.4
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DESCRIPTION OF THE VARIOUS POOLS AND THEIR PH VALUE,
WITH LISTS OF THE SPECIES CONTAINED IN THEM.

Coir' a' Ghruanda.

This is a typical circular rock-basin, bounded on all sides except the south by high walls of rock. The diameter of the pool itself is about 400 yards. It was not possible to ascertain the greatest depth, but it does not exceed 20 feet. The height of the pool is 2300 feet. On the north side the bottom is sandy, while on the south side, towards the outlet, the floor is covered with boulders. There is a great deal of water flowing out of the corrie, since it drains a large area and the rainfall is very high. Direct sunlight even in summer seems to be rather exceptional. The water is perfectly clear, and its pH was found to be 5.0. Vegetation is very scarce, as the rocks at this height are practically bare. The boulders at the bottom of the pool are covered with various filamentous algæ, and by hunting among these algæ it is possible to find both Copepoda and Cladocera. On the south-east side of the basin there is a certain amount of moss, and by squeezing this several Harpacticids were obtained.

The outflow of water is far too great to allow any Entomostraca to exist except at the edges of the pool and in the places indicated.

Species found:—

Cyclops vulgaris.
Leptocyclops agilis.
Attheyella pygmæa.
—— *zschokkei.*

Bosminia obtusirostris.
Acroperus harpæ.
Alonopsis elongata.
Alona affinis.

Coire Labain.

The rock-basin is much smaller than Coir' a' Ghrunnda, and the corrie itself is much more accessible. Its height is 1800 feet, and the pH of the water was found to be 5.0. There is more vegetation, and the amount of water flowing out must be considerably less. A large part of the floor of the pool is covered with grass. There was no difficulty in obtaining Copepoda, while the Cladocera were very abundant, though the number of species was small.

Species found:—

Cyclops vulgaris.
Leptocyclops agilis.
Attheyella pygmæa.

Acroperus harpæ.
Alonopsis elongata.
Chydorus sphaericus.

Roineval.

This consists of an isolated and very exposed promontory situated in the typical basalt district north-east of Sligachan. On the top of the promontory at a height of 1400 feet are two small tarns really formed by fallen rocks and peat. They are both largely filled with sphagnum. The pH of the one was 4.4 and of the other 4.6. In both cases the water appeared to be extremely cold.

Species obtained:—

Cyclops vulgaris.
—— *lucidulus.*
—— *robustus.*
—— *languidus.*
Leptocyclops agilis.
Attheyella pygmæa.

Bosminia obtusirostris.
Acantholebris curvirostris.
Alonopsis elongata.
Alonella nana.
Chydorus sphaericus.

Meall a' Mhaim.

On the saddle which separates Glenbrittle from the Sligachan district there is a fairly large pond. It is quite shallow and lies on alluvium. Vegetation is abundant,

though it consists chiefly of cotton-grass (*Eriophorum angustifolium*) and *Utricularia* sp. The height of the pond is about 1000 feet, pH 5.4. A small quantity of rain causes an outflow at either end. Copepoda and Cladocera were very fairly abundant. Among the latter *Eurycerus lamellatus* was particularly conspicuous in the catch.

Species found :—

<i>Cyclops vulgaris.</i>		<i>Alonopsis elongata.</i>
<i>Leptocyclops agilis.</i>		<i>Alona affinis.</i>
— <i>lilljeborgi.</i>		<i>Alonella nana.</i>
— <i>macrurusoides.</i>		<i>Chydorus latus.</i>
<i>Bosminia obtusirostris.</i>		<i>Eurycerus lamellatus.</i>

An Sgùman.

The name is here taken to include the numerous ponds and sphagnum-bogs that abound at the foot of the Cuillin Hills just above Glenbrittle House. The district really consists of a broad plateau about 500 feet above sea-level. It is covered with thick peat and abounds in small sphagnum-bogs and rather larger ponds. Vegetation is abundant, but it consists chiefly of sphagnum and cotton-grass. In the larger ponds the leaves of the yellow water-lily (*Nuphar lutea*) occur.

In all cases these ponds have a very low pH, 4.4–4.8, the latter figure being given by the larger ponds with *Nuphar*. In the sphagnum-bogs *Cyclops nanus* was easily obtained, while the larger ponds contained *Cyclops pietus*, *Sida crystallina*, and *Polyphemus pediculus*.

Species obtained :—

<i>Cyclops pietus.</i>		<i>Bosminia obtusirostris.</i>
— <i>vulgaris.</i>		<i>Drepanothrix dentata.</i>
— <i>nanus.</i>		<i>Acantholebris curvirostris.</i>
<i>Pachycyclops annulicornis.</i>		<i>Eurycerus lamellatus.</i>
<i>Leptocyclops lilljeborgi.</i>		<i>Alonopsis elongata.</i>
— <i>prasinus.</i>		<i>Alona affinis.</i>
<i>Sida crystallina.</i>		<i>Alonella excisa.</i>
<i>Latona stiferu.</i>		<i>Polyphemus pediculus.</i>
<i>Ceriodaphnia quadrangula.</i>		

Loch an' Fhìr-bhallaich.

This is a larger loch altogether, being about 600 yards long. It is a small valley dammed up by drift. Its height is 900 feet and its pH 5.2. Cladocera were not collected, though *Sida crystallina* was conspicuous.

Species obtained :—

<i>Diatomus laciniatus.</i>		<i>Leptocyclops lilljeborgi.</i>
<i>Cyclops vulgaris.</i>		<i>Sida crystallina.</i>

Creeg Mhor.

This is an enclosed loch, with a width of about 300 yards. Height about 300 feet above sea-level. pH 6.3. Vegetation abundant. Cladocera were not collected.

Species present:—

<i>Cyclops vulgaris.</i>		<i>Leptocyclops agilis.</i>
— <i>pictus.</i>		<i>Platycyclops fimbriatus.</i>
<i>Pachycyclops annulicornis.</i>		<i>Polyphemus pediculus.</i>

Glenbrittle Meadows.

Below Glenbrittle House, and only a few feet above sea-level, there are some meadows which contain some small pools. In one of these pools, with a pH of 5.8, the following species of Copepoda were found:—

<i>Cyclops bisetosus.</i>		<i>Leptocyclops lilljeborgi.</i>
— <i>lucidulus.</i>		— <i>prasinus.</i>
<i>Leptocyclops agilis.</i>		

In a tidal pool at Glenbrittle, with a pH value of 8.4, *Mesochra lilljeborgi* occurred very plentifully.

Only one specimen of *Daphnia* was found among the collections, and this specimen was damaged.

LXI.—*Exotic Muscaridæ (Diptera)*.—XXI. By J. R. MALLOCH, Bureau of Biological Survey, Washington, D.C.

Family *Muscidæ*.Subfamily *CENOSIINÆ*.GENUS *ANDERSONIA*, nov.

Generic Characters.—This genus has the normal single pair of backwardly curved upper orbital bristles and pre-sutural dorso-centrals. The lower calypter is much larger than the upper, there are three pairs of postsutural dorso-centrals present, and four subequal scutellars, the lower stigmatal bristle is microscopic, the costal vein ends at apex of fourth vein, and the sixth vein is not abruptly discontinued but gradually diminishes apically, disappearing about midway of margin of wing. The outstanding characters are the

presence of two posterior bristles on mid-tibia and one antero-ventral and two antero-dorsal bristles on hind tibia, all rather short.

Genotype, the following species.

Andersonia velutinifrons, sp. n.

Female.—Head black, frons velvety, triangle slightly shining, brownish-dusted on sides, orbits white-dusted, face, cheeks, and occiput, except the upper median portion, densely white-dusted; antennæ, aristæ, and palpi black. Thorax black, dorsum glossy, with two narrow anterior submedian vittæ and the posterior margin lightly, and the lateral margins densely, white-dusted; pleura densely white-dusted. Abdomen concolorous with thorax, anterior lateral margins and incurved lateral portions of tergites white-dusted. Legs black, trochanters, mid and hind femora (except their apices), and all the tibiæ yellow. Wings hyaline. Calyptræ whitish. Halteres yellow.

Frons longer than wide, at vertex about one-third of the head-width, becoming gradually wider to anterior margin, triangle extending to middle; each orbit with two anterior incurved bristles, and some fine short hairs, in addition to the upper bristle; inner verticals long, outer pair much shorter, not so long as postverticals and ocellars; arista with its longest hairs not as long as width of third antennal segment, the latter fully three times as long as second segment; face slightly concave; cheek not as high as width of third antennal segment; palpi long and rather slender. Thorax with the bristles stout, and less tapered than usual, the fine hairs extremely inconspicuous, some on disc of scutellum; anterior and lower sterno-pleural bristles very fine and short. Fore tibia with one posterior median bristle; fore femur with one or two preapical postero-ventral bristles; hind femur with one preapical antero-ventral bristle. Inner cross-vein of wing at about two-fifths from apex of discal cell and slightly beyond apex of first vein.

Length 4.5 mm.

Type, east side of edge of forest, Aberdare Mts., 7300 feet, 24. ii. 1911 (*T. J. Anderson*).

This genus is named in honour of the collector.

Subfamily PHAONINÆ.

Genus MULFORDIA, nov.

Generic Characters.—Head of female similar to that of *Dichatomyia*, Malloch, each orbit with a very strong bristle

at anterior extremity, a few much shorter bristles behind this, which are merely short hairs, on middle of orbits, and one short but strong bristle at level of anterior ocellus; inner vertical bristles long and strong, outer pair very short. Prosternum and centre of propleura bare; pteropleura with one or two short fine hairs near upper margin, which may conceivably be absent in some specimens; metathoracic spiracle with a few black setulose hairs on hind margin; hypopleura with fine hairs centrally; prealar bristle absent; no hairs below calypter. Basal abdominal sternite haired; tergal bristles sparse and long. Hind tibia without a postero-dorsal bristle; hind coxæ haired at apices above bases of femora as in *Lasiops*, Meigen, and some other genera. First wing-vein bare, third with a few short black hairs near base below; fourth slightly bent forward at apex.

Genotype, the following species.

Mulfordia ferruginea, sp. n.

Female.—Ferrugineous, slightly shining. Frons, occiput, centre of face, second antennal segment, and palpi fuscous. Thorax slightly grey-dusted, and with traces of four darker vittæ on dorsum; pleura fuscous, pale only on the sutures; fore coxæ brownish; tarsi black. Wings yellowish hyaline, the veins yellow. Calyptæ and halteres ferruginous.

Eyes almost bare; frons at vertex not over one-fourth of the head-width, widened anteriorly; ocellar bristles long and strong; arista plumose; cheek nearly twice as high as width of third antennal segment. Thorax with 2+3 dorso-centrals, two pairs of intra-alars, and a pair of prescutellar acrostichals; hairs present on sides of scutellum, but not below. Abdomen obconical. Fore tibia with a median antero-dorsal bristle; mid-femur with two or three strong bristles near base on postero-ventral surface, and an anterior bristle at middle; mid-tibia with two or three posterior bristles; hind femur with short bristles on apical half or more of antero-ventral surface and a few on median part of postero-ventral; hind tibia with one antero-dorsal and one or two antero-ventral bristles; basal segment of all tarsi at least half as long as tibiæ. Inner cross-vein close to middle of discal cell.

Length 8.5 mm.

Type, Tumupasa, Bolivia, December (*W. M. Mann*). Mulford Biological Expedition. Type in U.S. National Museum.

This genus is included in my key to the genera of Muscidæ of the world now ready for the press.

Genus *DICHÆTOMYIA*, Malloch.

In a recent paper Dr. G. Enderlein has, apparently without consulting the recent literature on this family, erected some new genera for previously described species. One of these, *Lophomala*, was erected for this group and is a straight synonym of *Dichæatomyia*. He selected no genotype for his concept, so I now designate as the genotype of *Lophomyia*, *flavipalpis*, Stein. Enderlein's genus is heterogeneous.

Dichæatomyia latifrons, sp. n.

Male.—Black, shining; frons opaque black, parafacials silvery above; thoracic dorsum slightly brownish-grey dusted and faintly vittate; abdomen glossy black; legs black, tibiæ brownish; wings smoky, darkest basally; calyptæ and halteres fuscous.

Frons about one-third of the head-width, bristles long except on middle of orbits; third antennal segment about three times as long as second; arista plumose. Thoracic dorsum with two pairs of prescutellar dorso-centrals, the anterior pair shorter than the long hind pair, and only two long strong pairs of postsutural dorso-centrals, the anterior two pairs minute, practically indistinguishable; some hairs below lower calypter. Abdomen elongate-ovate, with a pair of long bristles on middle of hind margin of second visible tergite, and strong bristles at apices of third and fourth and middle of fourth. Fore tibia with an antero-dorsal and a posterior median bristle; mid-tibia with two posterior bristles; hind femur with one or two preapical antero-ventral bristles and a few short postero-ventral setulæ. Wings rather short, rounded at apices, costal setulæ longer than usual, especially basad of apex of auxiliary vein; inner cross-vein about two-fifths from base of discal cell; fourth vein very slightly bent forward at apex.

Length 7 mm.

Type, Kampala, Uganda, 17. xi. 1915 (C. C. Gowdey).

This species is closely related to *pallitarsis* (Stein), but the frons is wider, the anterior presutural dorso-centrals are stronger, the humeri are not yellowish, there is but one antero-dorsal bristle on hind tibia, and there are strong bristles on hind margin of the second abdominal tergite.

Dichæatomyia elegans, sp. n.

Female.—Head testaceous, occiput, upper orbits, and ocellar triangle blackish, remainder of frons fuscous, all

with grey dusting; face yellow-dusted; antennæ and palpi honey-yellow; aristæ black, yellow at bases. Thorax testaceous-yellow, with a broad dorso-central grey-dusted vitta, two equally broad black sublateral vittæ which extend over sides of scutellum, and the lateral mesonotal margins yellow-dusted; postnotum brownish; pleura blackish brown except along upper margins. Abdomen shining reddish orange. Legs coloured as abdomen. Wings yellowish on basal halves, fuscous on apical halves. Calyptreæ and halteres yellow.

Frons about one-fourth of the head-width at vertex, widened anteriorly, the orbital bristling normal, ocellars microscopic: arista plumose: third antennal segment fully three times as long as second; cheeks linear; palpi slightly dilated apically. Thorax with 2+3 strong dorso-centrals, two pairs of intra-alars, no prescutellar acrostichals, setulose hairs on sides of scutellum, some fine hairs on middle of hypopleura, and three equally spaced sterno-pleurals. Abdomen elongate-ovate, median and apical bristles on third and fourth visible tergites. Fore femur with postero-ventral bristles long only on apical half; hind femur with two or three preapical antero-ventral bristles; all femora with an apical scale-like expansion on anterior side; fore tibia with a short median antero-dorsal bristle; mid-tibia with two posterior bristles; hind tibia with one antero-dorsal and two short antero-ventral bristles, and a short setula on postero-dorsal side at middle. Only the underside of base of third vein setulose; fourth vein not noticeably bent forward at apex.

Length 8 mm.

Type, Suva, Fiji Islands, 20. xii. 1910 (*Dr. P. H. Manson-Bahr*).

The peculiar scale-like expansion of the apices of femora is similar to that of the fore femur of females of the Australian species *Helina addita* (Walker), and may be confined to the female here also. No species of the genus known to me has bicoloured wings, conspicuously bivittate thoracic dorsum, and pale antennæ and palpi, as in the above species. The only species with conspicuously bicoloured wings like those of *elegans* that are known to me occur on the island of Buru.

Genus DREPANOCNEMIS, Stein.

This genus belongs to the *Limnophora* group and is known only in the male sex. Stein, in his key to the genera of Muscidæ of the world, placed it amongst the Cœnosiinæ

because of the presence of but one pair of long presutural dorso-central bristles, but this character alone is insufficient guide to the relationships of a genus. Neither is the wide frons of the male an index to generic relationships, as many genera of Phaoniinæ have this character, and the details of the frons in *Drepanocnemis* agree with those of Phaoniinæ and not with Cœnosiinæ. Important characters not mentioned by Stein follow:—Lower stigmatal bristles not directed downward; prosternum, centre of propleura, pteropleura, hypopleura, and sides and ventral surface of scutellum bare; no hairs on wing-veins; third and fourth wing-veins subparallel; lower calypter much larger than upper. The very broad fore tibia of the male, with the long bristle on postero-dorsal surface basad of middle, distinguish this sex from that of any other genus known to me, but without seeing the female it is impossible to decide definitely if the species are entitled to full generic rank.

Stein described two species; the one before me now is apparently distinct from either of these and is herein described as new.

Drepanocnemis griseovirens, sp. n.

Male.—Black, shining, the frons densely grey-green dusted; abdomen when seen from behind rather densely greenish-grey dusted, tergites 2, 3, and 4 each with a large shining black spot, which extends over one-third of the dorsal width on anterior margin and almost the entire dorsal width on posterior margin. Wings greyish hyaline. Calyptreæ white. Halteres brown.

Eyes bare; frons at vertex about one-third of the head-width; orbits not differentiated, upper bristle long and strong, much curved, and directed backward, second moderately long, curved inward, like the fine short hairs anterior to it, the anterior setulæ stronger and longer; verticals long; ocellars fine, rather long, divergent; postverticals almost hair-like; arista swollen at base, pubescent; cheeks almost linear, with strong hairs. Thorax with one very short, and one long, pair of presutural acrostichals and dorso-centrals; posterior dorso-centrals three long pairs. Setulose hairs on sides of first visible tergite quite long and numerous; fifth tergite with four fine long bristles; fifth sternite quite deeply cleft. Ventral bristles on fore femur fine, curled at apices, the femur compressed, its greatest width about one-fifth of its length, the anterior surface opaque black, all surfaces hairy, postero-dorsal edge with one long bristle about

one-fifth from base, the apex of which is slightly curled, and a series of closely placed, slightly lanceolate, fine bristles; fore tarsus shorter than tibia; mid-tibia with one very short antero-dorsal and one longer postero-dorsal bristle; hind femur thicker than the other pairs, with many fine soft ventral hairs, densest at middle on the postero-ventral surface, and about five bristles on apical half of antero-ventral surface, the basal one longest; hind tibia with a long fine antero-dorsal median bristle. Inner cross-vein a little beyond middle of discal cell.

Length 3.5 mm.

Type and one paratype, Huariaca, Peru, 10,750 feet, 21. xii. 1913 (*C. H. T. Townsend*).

Of the two species described by Stein, *hirticeps* has densely hairy eyes and *doræ* has the frons brown and the dorsal spots on abdomen are not fused in centre.

As no genotype has been designated, I herein name *doræ*, Stein, and assign the genus to the subfamily Phaoninæ.

Genus *Idiopygus*, Malloch.

The members of this genus present a striking similarity in habits and coloration to certain species of the genus *Sarcophaga* occurring in Africa, of which group *spilogaster*, Wiedemann, is typical. The peculiar spotting of the cross-veins of the wings is very characteristic.

In Part III. of this series of papers I presented a synopsis of the species of the genus known to me. Before me now there is a specimen which appears to be distinct from any of those species, and below I describe it as new.

Idiopygus wroughtoni, sp. n.

Male.—Similar to *hirtiventris*, Malloch, in colour, the short central vitta on the mesonotum not extending over scutellum. The paired spots on dorsum of abdomen are quite conspicuous and present on first to fourth visible tergites inclusive, while there are also quite noticeable dark dots at bases of the larger bristles.

Frons about one-fifth of the head-width, each orbit with a rather wide gap between the bristles at middle. Dorso-centrals 2+3; both pairs of intra-alars present; prealar absent; hypopleura bare. Abdominal sternites broad, with erect, quite dense, long, fine, black hairs; processes of fifth sternite broad, rounded at apices, with fine, rather dense hairs of moderate length. Fore femur with two series of

long postero-ventral bristles; fore tibia without long hairs or posterior median bristle, two short antero-dorsal bristles present; fore tarsus with short fine hairs on both sides; fore coxæ rather densely furnished with long hair-like bristles on apical halves; mesosternum slightly produced and with dense black hairs and bristles which incline backward; mid-femur densely furnished with long hairs ventrally to beyond middle, more bristle-like and erect on antero-ventral surface; mid-tibia without long ventral hairs; mid-tarsus normal; hind trochanters with soft short crinkly hairs; hind femur with some fine hairs at extreme base below, and a double series of strong antero-ventral bristles apically; hind tibia with a prominent, apically rounded process at apex on ventral surface, no long hairs, and two antero-dorsal bristles.

Length 5.5 mm.

Type, Willow Grange, Natal (*R. C. Wroughton*).

Named in honour of the collector.

This species, as already stated, is very similar to *hirtiventris*, Malloch, but the latter has some fine hairs on hypopleura, and long hairs on ventral surface of hind femur, neither of which are present in the new species.

Genus *HELINA* Robineau-Desvoidy.

Helina dasyops (Macquart).

Male and female.—A black species, superficially resembling *Spilaria lugubris* (Fallen). Head black, orbits and parafacials silvery-white dusted. Thorax black, rather distinctly quadrivittate. Abdomen brownish-grey dusted, hardly checkered. Legs black, apices of fore tibiæ, and all of mid and hind femora and tibiæ rufous yellow in male, similarly coloured in female, but the fore tibiæ not dark at bases. Wings greyish. Calyptre and halteres yellow.

Eyes quite densely haired in male, less noticeably so in female; narrowest part of male frons nearly twice as wide as third antennal segment, orbits setulose from near anterior ocellus; parafacials distinctly wider than third antennal segment, and a little less wide than height of cheek; arista with rather dense hairs, which are not as long as half the width of third antennal segment. Thorax with 2+4 long dorso-centrals and one or two pairs of long presutural acrostichals; three pairs of long postsutural intra-alars present, the prealar long, the dorsal hairs fine, long, and erect, no hairs on sides of scutellum or on hypopleura, and the sternopleurals 2+2. Abdomen elongate-ovate, the hairs long and

setulose on sides apically. Fore tibia with a long posterior median bristle; mid-tibia with one or two antero-dorsal and three or four posterior bristles; hind femur in male with some long bristles on apical half of antero-ventral and some long setulose hairs on apical fourth of postero-ventral surface; in female the bristles and hairs are less numerous and shorter; hind tibia in male with two or three long antero-dorsal bristles and two series of long, finer, bristles, one on the antero-ventral and the other on the posterior surface; in the female there are two or three antero-dorsal and three or more antero-ventral bristles, and sometimes one posterior bristle near base. Wings with the veins bare; first posterior cell not narrowed at apex.

Length 7-9 mm.

Falkland Islands, from whence it was originally described.

Stein in 1911 described a South American species, *Mydæa dasyops*, which is congeneric with the above. I propose as a substitute for *dasyops*, Stein, the name *dasyophthalma*, nom. nov.

Subfamily *MUSCINÆ*.

Genus *ORTHELLIA*, Robineau-Desvoidy.

Orthellia lasiophthalma, sp. n.

Male.—Head black; frons shining black on orbits: parafacials rather densely, face more thinly white-dusted; antennæ and palpi black. Thorax deep metallic blue-green, with two narrow submedian presutural dark vittæ, between which there is faint white dust. Abdomen concolorous with thorax, whitish-dusted only on the incurved lateral portions of tergites. Legs black. Wings hyaline, brownish on base of costa to a little beyond humeral vein. Lower calypter black, upper one white. Halteres fuscous.

Eyes quite conspicuously haired, facets moderately enlarged above in front; frons fully as wide as third antennal segment, the orbits with rather dense erect hairs on their entire length; inner vertical bristle long, the outer absent; facial ridges haired on almost their entire length. Thorax with rather dense fine erect black hairs of moderate length, amongst which there are distinguishable the posthumeral prescutellar acrostichals, one strong, and one very weak and short, pair of postsutural dorso-centrals, and one pair of intra-alars on disc; sides of scutellum haired. Abdomen short-ovate, with erect black hairs which are longest on sides and apically, and without bristles. Fore tibia without

a median posterior bristle; mid-tibia without an antero-dorsal bristle; hind femur with bristles on apical half of antero-ventral surface; antero-dorsal and antero-ventral bristles on hind tibia short, the calcar present. Entire surface of wing microscopically haired.

Length 7 mm.

Type, Kenya Colony, Lumbwa Reserve, iv. 1920 (*F. W. Dry*).

This species runs to *hirticeps*, Stein, in my key to the species of this genus in Part XI. of this series of papers. That species, however, is unicolorous violet-black in colour, the postsutural dorso-centrals are in four pairs, with the two anterior pairs weak, and the halteres are yellow.

Orthellia trispina, sp. n.

Female.—Similar in colour to *nigriceps*, Macquart, the head black, upper orbits shining black, thorax and abdomen metallic blue-green, with violet reflections, most pronounced on fourth tergite of latter. Wings greyish hyaline. Calyptreæ brownish. Knobs of halteres yellow.

Frons at vertex about one-fifth of the head-width, widened anteriorly, the orbits very narrow, each with one long and one short forwardly directed supraorbital; vibrissal angle but slightly produced. Thorax with 1+3 pairs of strong dorso-centrals, and one pair of intra-alars; sterno-pleurals 1+3. No macrochaetæ on abdomen. Fore tibia without a median posterior bristle; mid-tibia without an antero-dorsal bristle, the posterior and ventral bristles strong; hind femur with a rather widely spaced series of long antero-ventral bristles, and one about middle of postero-ventral surface; hind tibia with distinct postero-dorsal bristle, one moderately long, and a series of short bristles on antero-dorsal surface, and two short antero-ventral bristles. Wings normal, the base of stem-vein with a long setulose hair on hind side above.

Length 8 mm.

Type, Wai Lima Z., Sumatra (*Karny*).

This species differs from *abnormis*, Malloch (Africa), and *nigriceps*, Macquart (Australia), the only two species known to me which run to caption 11 in my key to the species of this genus, in having three strong pairs of postsutural dorso-centrals instead of four pairs.

Genus MORELLIA, Robineau-Desvoidy.

Morellia minor, sp. n.

Male.—A species very similar to *prolectata*, Walker, and

calyptata, Stein, to the latter of which it runs in my key to the species of the genus in Part XI. of this series of papers. From *prolectata* it differs in the smaller size and entirely yellow calyptre and from it and *calyptata* in having three or more long fine bristles on apical half of the postero-ventral surface of fore tibia, the longest of which is much longer than the tibial diameter. The general colour is a glossy blue-black, with the usual white-dusted dorsal vittæ on thorax and markings on abdomen. The eyes are bare, the frons is almost linear, there are two pairs of post-sutural dorso-centrals present, the mid-femur has some strong apical dorsal bristles, the mid-tibia has a comb-like series on minute bristles at base on antero-dorsal surface, the hind femur has an antero-ventral series of bristles, strongest apically, and a weaker series on basal half of postero-ventral surface, and the hind tibia has a series of short antero-dorsal bristles, two beyond middle longer than the rest, but shorter than the tibial diameter, three short antero-ventral bristles, and a few almost indistinguishable hairs on apical half of postero-ventral surface. Otherwise as *calyptata*.

Type, Zanzibar, near Mazi Moja (*H. J. Snell*).

Subfamily *EGININÆ*.

In my first alignment of this group I placed it with the Tachinidæ, where it has usually been placed by other writers. The proper systematic position, however, is very difficult to determine. If the hypopleural bristles are to be accepted as of primary importance in determining the limits of the major groups, then the conclusion might be that Egininæ is a subfamily of Calliphoridæ, there being no developed postscutellum evident. The wing-venation, however, is typical of Phaoninæ as are also most of the other characters, including the lack of basal bristles on ventral surface of hind metatarsus. I am therefore inclined to remove the group to the family Muscidæ and consider it a subfamily, distinguished from all others therein by the presence of distinct bristles on hypopleura close to spiracle.

I present below the description of a new genus and species of the subfamily. The species are evidently rare in nature, and though the general habitus and distinguishing features of the insects are quite obvious to the average student of Diptera, it has been necessary to erect a new genus for each of the five species now known. Whether these are remnants of a disappearing group or recent mutations I do not care to suggest. Below I append a key to the genera, all of which

are found in the Eastern Hemisphere. The key is based upon actual examination of the genotypes.

Key to the Genera.

1. Prosternum setulose : eyes of male separated by about one-third of the head-width ; femora without short stout preapical antero-ventral spines ; sixth wing-vein traceable to margin of wing (European) *Egmia*, Rob.-Des.
Prosternum bare (Oriental) 2.
2. Sixth wing-vein distinctly traceable to margin of wing ; frons of male one-third of the head-width ; anterior intra-alar and pre-scutellar acrostichal bristles undeveloped ; all femora with short stout antero-ventral spines on part of their length *Xenotachina*, Mall.
Sixth wing-vein ceasing before attaining margin of wing ; frons of male less than one-fifth of the head-width ; pre-scutellar acrostichal bristles present 3.
3. Femora lacking preapical comb of short stout spines ; hind tibia with one antero-dorsal bristle ; frons of male about one-eighth of the head-width *Eginiella*, Mall.
At least the fore and mid femora with preapical antero-ventral comb of short stout spines 4.
4. Anterior intra-alar bristle long and strong ; the central discal bristles on tergites 2 to 4 inclusive as long as those at apices of the tergites *Syngamoptera*, Schnabl.
Anterior intra-alar bristle undeveloped ; the central discal bristles absent from second tergite, very weak on tergites 3 and 4.... *Macroeginia*, gen. nov.

GENUS *MACROEGINIA*, nov.

Generic Characters.—Similar to *Syngamoptera* in general habitus and in all characters except those mentioned in the foregoing synopsis.

Genotype, the following species.

Macroeginia pendleburyi, sp. n.

Male.—Testaceous-yellow, slightly shining. Interfrontalia opaque dark brown, orbits, parafacials, and face white-dusted ; occiput fuscous (except on lower part) and grey-dusted ; antennæ pale yellow ; aristæ brown, paler at bases ; palpi testaceous. Thorax slightly darker on disc of mesonotum, the lateral margins pale-dusted, and without evident vittæ. Abdomen with a large blackish elongate central

mark on each tergite except first. Tarsi fuscous. Wings yellowish hyaline. Halteres yellow.

Frons at vertex about one-eighth of the head-width, widened at anterior margin, orbits narrow, not obliterating interfrontalia, and strongly bristled on their entire length except behind anterior ocellus; ocellar bristles very small; vertical bristles shorter than orbitals; arista long plumose; third antennal segment about twice as long as second; parafacials narrow. Thorax with 2+3 pairs of dorso-centrals, a distinct pair of prescutellar acrostichals, only one pair of intra-alars, no prealar, and a bare stripe on each side of the two central series of fine presutural acrostichal hairs; sterno-pleurals 1+2; scutellum with four strong marginal bristles, the basal pair almost indistinguishable from the discal setulæ; about six hypopleural bristles present. Abdomen cylindrical, tapered to apex, the apical bristles on tergites long and strong, none on middle of apex of first visible tergite or on middle of disc of second, those on middle of disc of third and fourth very short; hypopygium small, almost concealed. Fore femur with a few rather weak short preapical antero-ventral bristles, mid and hind femora each with a series of short stout bristles on apical third or less, which are quite distinct from the much longer and finer bristles basal of them, the ventral surfaces of hind femora with quite long, fine, and rather dense black hairs; hind tibia with the ventral hairs longer than usual, the three antero-ventral bristles slender, and two or three antero-dorsal and postero-dorsal bristles. Costal vein very thin from beyond apex of third to apex of fourth vein; ultimate section of fourth vein about 2.5 as long as penultimate section.

Length 10 mm.

Type, Batang Padang, Perak, Federated Malay States, 15-20 miles from Tapah Padang, 9. iii. 1925 (*H. M. Pendlebury*).

Named in honour of the collector, and the type deposited in the British Museum at his request.

Family Calliphoridae.

I have been actively engaged for some two or three years in working up material in this family from all over the world in the hope that it might be possible to develop a system for the separation of the major groups. Unfortunately, lack of material has to some extent prevented completion of the work as soon as I had hoped, and with the

exception of a few isolated papers on groups from various parts of the Orient and Australia I have been unable to accomplish very much. I have, however, been able to discover certain characters of structure which can be used in distinguishing genera and segregates of genera, and to some extent also subfamilies, and in the hope that it may be possible for other workers to test these out I am including them in such papers as I submit for publication, often in the species-descriptions.

Subfamily RHINIINÆ.

Genus STRONGYLONEURA, Bigot.

In this genus, as I pointed out in a preceding part of this series of papers, there are several well-defined segregates which might be accorded at least subgeneric rank by most specialists on Muscoidea. Without access to a greater number of species in larger quantities than are at present available to me, I do not care to adopt this course, but it is probable that ultimately *Thelycheta*, B. & B., and *Strongyloneura*, Bigot, will be accepted as the names for my segregates B and C respectively. I give below a synopsis of characters for dividing the groups.

Synopsis of Groups.

- | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1. First wing-vein setulose below at base, the setulæ in the hollow and difficult to distinguish unless with a very high-power lens; postalar declivity haired in part, sometimes microscopically so; fourth abdominal tergite with strong discal bristles | Group A. |
| First wing-vein without setulæ at base below | 2. |
| 2. Lower calypter produced lobe-like at base on inner side, so that its margin lies close against basal lateral angle of scutellum: postalar declivity usually distinctly haired in part | Group B. |
| Lower calypter straight, or almost so, on basal half of its inner margin, and well separated from lateral basal angle of scutellum; postalar declivity normally entirely bare . | Group C. |

Group A.

This group contains species in which there are some setulæ in the hollow on the under side of basal part of first vein.

I have before me four species of the group. One of these is very similar in all characters, colour, etc., to the description of *viridaurea*, Wiedemann, and has the lower calypter lobulate on inner side at base, which character would throw it into Group B if the setulæ on first vein were disregarded.

The other three species have the lower calypter straight on inner margin basally and would fall into Group C if the setulæ on first vein were disregarded. It is this parallelism in the various groups that leads me to consider the species as all belonging to the same genus, though it may not so influence other systematists.

I append below a synopsis of the specific characters of the group. I have failed to trace three of the species to described forms, and all of them are from the Orient.

Key to the Species.

1. Lower calypter as broad as long, very evidently lobulate on inner margin at base, and contiguous to lateral basal angle of scutellum; mid-tibia of male without a ventral submedian bristle; pleural hairs golden yellow except a few on upper margin of mesopleura; hairs on underside of basal section of first vein yellow, the same vein with a series of fine yellow hairs above the black bristles on basal section above *cupreoviridis*, sp. n.
- Lower calypter longer than broad, its inner margin straight for some distance from base, and standing well clear of base of scutellum; hairs on at least all of the mesopleura black; setulæ at base of first vein on underside black; first (stem) vein with a single series of black bristles on upper side of its basal section 2.
2. Mid-tibia of male without a strong submedian ventral bristle; wings greyish on basal half, conspicuously blackened on apical half; thorax metallic blue, when seen from behind with drab-grey dusting in front of suture, and no evident vittæ; narrowest part of frons in male not nearly as wide as distance across posterior ocelli ... *micans*, Bigot.
- Mid-tibia of male with a strong submedian ventral bristle 3.
3. Thorax conspicuously grey-dusted, mesonotum when seen from behind with three black vittæ, which are conspicuous behind suture; disc of scutellum densely grey-dusted, checkered; fourth visible tergite of abdomen in male without, that of female with, long strong central discal bristles; sterno-pleura with dense whitish-grey dusting and pale-haired .. *vittigera*, sp. n.
- Thorax inconspicuously grey-dusted, noticeably so only in front of suture when seen from behind, and without evident vittæ; scutellum metallic blue-green, undusted; fourth visible tergite in male with long strong central discal bristles; sterno-pleura metallic blue-green, with black hairs *philippinensis*, sp. n.

Strongyloneura cupreoviridis, sp. n.

Male and female.—Head testaceous-yellow, interfrontalia brownish fuscous, upper occiput black, glossy except on the margin and below, cheek brownish on a small part at middle above, the entire orbits, parafacials, and cheeks densely yellow-dusted; antennæ and palpi testaceous-yellow, third segment of former slightly browned above; aristæ fuscous, yellow basally. Thorax metallic green, with greyish dusting, most dense on pleura, which gives it a rather dull appearance, the surface with coppery reflections, especially on anterior half of mesonotum; scutellum unicolorous green; pleural hairs yellow, the only black hairs present confined to upper margin of mesopleura; a few pale hairs amongst the black ones on lateral margins of mesonotum. Abdomen metallic green, with a diffuse blackish central vitta and apical marginal fascia on each tergite except the first visible one, the whole surface whitish-dusted, but changeable according to the position of the abdomen, in the male there is a very pronounced coppery tinge on the apical two tergites both above and below; hairs black on dorsum, yellow on venter. Legs black, femora with greenish or coppery tinge, tibiæ and bases of tarsi brownish yellow; fore femora black-haired on posterior surface. Wings yellowish hyaline, faintly browned apically on costa. Calyptreæ and halteres yellow.

Eye-facets in male normal, the frons in same sex linear; antennæ a little over half of the length of face, with a narrow carina separating their bases; parafacial a little wider than third antennal segment, with fine black hairs; cheek as high as length of antennæ, black-haired in front. Prealar bristle less than half as long as the anterior supra-alar; pteropleura with one black bristle; scutellum with six long marginal and two discal bristles. Fourth visible tergite in both sexes with strong central discal bristles; hypopygium of moderate size. Mid-tibia of male without, of female with, a strong submedian ventral bristle; hind coxæ with pale hairs above at apices. Apical section of fourth wing-vein as in *Musca domestica*.

Length 8–9 mm.

Type, male, Kuala Lumpur, Selangor, F.M.S., Gombak Valley, 11. x. 1921 (*F. M. Pendlebury*); allotype, Malay Peninsula, ex coll. Agr. Dept., Bukit Kutu, 15. xii. 1915.

Type in British Museum.

One of several species which agree very well with the description of *viridaurea*, Wiedemann, but the only one in

which the first vein has setulæ below on the basal part and in which there are hairs on hind coxæ at apices above. This last character is very rare in this genus, though met with in several other genera in the family, mostly in Calliphorinæ.

Strongyloneura micans (Bigot).

Male and female.—Head fuscous; occiput glossy except on margin and lower part; orbits, parafacials, and cheeks yellowish-grey dusted, the cheeks yellow on upper and lower margins and in front; face testaceous; antennæ and palpi yellow-testaceous, third segment of former brownish above; hairs on cheeks black, some of those on lower part of occiput alone yellow. Thorax brilliant blue-green, metallic, mesonotum with slight grey dusting in front of suture when seen from behind, and only in female with noticeable dark vittæ anteriorly, though there are traces of two coppery submedian vittæ in front of suture: scutellum undusted; sterno-pleura lightly whitish-dusted; all pleural hairs black. Abdomen coloured as thorax, but with more evident white dusting, especially below and on anterior lateral angles of tergites, each tergite with a diffuse central vitta and apical fascia blackish, sometimes forming a large dark subtriangular mark on each; abdominal hairs black, pale hairs confined to second sternite. Legs black, fore femora greenish, tibiæ and bases of tarsi usually brownish yellow. Wings greyish, conspicuously blackened on apical halves, most densely so costally. Lower calypter brownish, its base and the upper one white in male, both whitish in female. Halteres yellow.

Structurally different from the preceding species in having the antennæ closer together at bases and about two-thirds as long as face; the thorax usually with 1+2 instead of 2+4 pairs of acrostichals; the bend of fourth vein in male more rounded; and no fine hairs on hind coxæ at apices above.

Length 8–9 mm.

Localities.—Kuala Lumpur, Selangor, F.M.S., 20. x. 1921 (*H. M. Pendlebury*); Depok, Java (*Bryant and Palmer*); one male (headless) and one female, Nakon Sri Tamarat Khao Ram, Peninsular Siam, 1–2. iii. 1922 (*H. M. Pendlebury*); one male (dissected), Mt. Salak, Java, and one female, Bantar Gebang, Java (*Bryant and Palmer*); one female, Kolumbagan, Mindanao, and one female, Mt.

Maquiling, Luzon Province, Philippine Islands (*C. F. Baker*).

The last-mentioned specimen differs from the others in being deep violet-blue in colour, and in having the legs entirely black, but in no other respect.

I am indebted to Mr. J. E. Collin for data upon Bigot's type of *Cosmina micans* which provide a basis for this identification.

Strongyloneura vittigera, sp. n.

Male and female.—Occiput, orbits, and upper parafacials fuscous, cheeks and face testaceous, all obscured by dense yellowish dusting; interfrontalia brown; antennæ and palpi yellowish testaceous; hairs on lower occiput yellow, the others black. Thorax metallic green, quite densely pale grey-dusted, the dust on dorsum checkered, the mesonotum with three rather broad and conspicuous black vittæ; sternopleura quite densely whitish-dusted; pleural hairs yellow, those on mesopleura black; both spiracular coverings blackish. Abdomen coloured as thorax, with dense dusting and black markings even more evident than in last species, hairs mixed black and pale below. Legs black, femora slightly greyish-dusted and tinged with green; tibiæ and bases of tarsi brownish yellow. Wings hyaline, sometimes with a faint dark cloud along apical half of costa. Calyptreæ white. Halteres yellow.

Frons of male about twice as wide as, parafacial fully as wide as, third antennal segment; palpi of female very slightly wider than those of male. Thorax with 2+3 pairs of acrostichals. Fourth visible abdominal tergite with the central discal bristles weak in male, very strong in female; female with a strong ventral submedian bristle on mid-tibia, male without one. Bend of fourth vein almost as in *Musca domestica*.

Length 7-7.5 mm.

Type, male, Kuala Taku, Pahang, F.M.S., 5. xii. 1921; allotype, Kuala Lumpur, Selangor, F.M.S., 17. ix. 1922 (*H. M. Pendlebury*).

Strongyloneura philippinensis, sp. n.

Male.—Very similar to *bipennis*, but more green than blue in colour, and with the apical portions of wings less noticeably darkened. Structurally distinguished as noted in the foregoing key, and by having the abdomen more robust at apex, the hypopygium being larger and more strongly

bristled. In both specimens before me the legs are entirely black.

Length 7-9 mm.

Type. Los Baños; paratype, Surigao, Mindanao, Philippine Islands (*C. F. Baker*). Type in author's collection.

I hope to be able to publish further data upon this species when more specimens come to hand.

It is possible that *apicipennis*, Senior-White, belongs to this group, but the description does not suit any of the species included herein.

Group B.

This group is probably equivalent to *Thelychæta*, B. & B., but I am not absolutely certain of this, having no authentic specimens of *chalybea*, B. & B., which is the genotype. The authors of the genus made no mention of the structure of the lower calypter, which I use to distinguish the group, and without a careful comparison of several species which are very similar in colour-characters it is impossible to decide which is *chalybea*. I hope that I may be able to obtain a loan of the type-specimen of *chalybea* shortly, and may also obtain some of the related species, the types of which are in European Museums.

All of the species of this group are from Africa and the Orient, one being from China, and none occur in Australia or the New World. Even the most recently described species of the group are unidentifiable from the descriptions, as the principal characters for the differentiation of the species are not mentioned by any author, and only examination of types will insure correct identifications. There appear to me to be a very large number of species in the Orient, and possibly hypopygial characters will have to be examined to decide definitely just how many there are.

Strongyloneura pseudolucilia, sp. n.

Male and *female*. — Bright metallic green, with slight coppery reflections and light whitish dusting on thoracic dorsum and abdominal tergites. Head testaceous-yellow, frons and occiput fuscous, the dusting on occiput greyish, that on remainder of head yellow; antennæ and palpi testaceous-yellow, third segment of former slightly browned; aristæ fuscous, paler at bases; hairs on lower part of cheeks and occiput yellow, upper hairs on cheeks and those on parafacials black. Thorax with faint traces of a pair of narrow presutural submedial dark vittæ on mesonotum; some pale

hairs at notopleural bristles; all pleural hairs yellow except on upper two-thirds of mesopleuræ; anterior spiracular covering brown. Abdomen with a quite noticeable purplish dorso-central vitta, and narrow apices to tergites of same colour except that of fourth which is broadly deep blue; second sternite pale-haired. Legs black, femora blue-tinged, tibiæ sometimes brownish. Wings slightly brownish, more evidently so basally. Calyptræ white, slightly tinged with yellow. Halteres yellow.

Frons of male at narrowest point about twice as wide as the rather narrow third antennal segment, orbits and parafacials with quite strong, short, black hairs; third antennal segment fully twice as long as second, and not as wide as parafacial; face slightly rounded but not carinate; cheek as high as length of antenna. Thorax with 2+3 acrostichals and 2 or 3+4 dorso-centrals; postalar declivity bare. Abdomen stout, hairs strong, fourth tergite with a transverse series of strong bristles; hypopygium stout. Male without, female with, a submedian ventral bristle on mid-tibia. Bend of apical section of fourth vein subangular.

Length 8-9 mm.

Type, male, allotype, and two male paratypes, Mt. Omei, Szechuen, China, Si Gi Pin, 1925 (*D. C. Graham*). Type in U.S. National Museum.

This species has much the same habitus as *natalensis*, but has the lower calypter lobulate on inner side basally. The lack of hairs on postalar declivity is distinctive, most of the other species have some quite noticeable hairs present.

Strongyloneura grossa, Villeneuve.

This species belongs to this group. The antennæ are separated by a flat carina which is as broad as one antennal insertion, and the fourth abdominal tergite lacks discal bristles and is transverse at apex in the female.

I have previously recorded the species.

Strongyloneura jacatrix, Villeneuve.

The two specimens of this species I have before me were given to me by Mr. C. H. Curran and were compared by him with examples so identified by Dr. Villeneuve. The specimens do not agree absolutely with the description, having the antennæ fuscous except the base of third segment and the palpi black, while the description gives both "obscure

testaceis." However, I accept the identification. The hypopygium is as figs. 2 *a* & *b*.

The specimens are from the type-locality, Stanleyville, Belgian Congo.

Fig. 2.

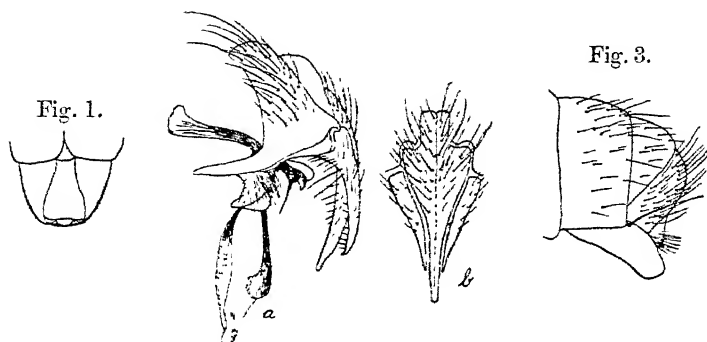


Fig. 1.—*Strongyloneura prasina*, apex of venter of female.

Fig. 2.—*Strongyloneura jacatrix*. *a*, hypopygium from side; *b*, forceps of same from behind.

Fig. 3.—*Strongyloneura pendula*, apex of abdomen of male from side.

Strongyloneura viridocana, Hough.

Two males before me I assign to this species. They closely resemble the above-mentioned species in the male sex, but the thoracic dorsum in *jacatrix* lacks whitish dusting, while in *viridocana* it is rather evenly, though sparsely, white-dusted, most evident in front when the thorax is seen from behind; in both examples there are about eight black bristles on the upper portion of the pteropleura, while in both sexes of *jacatrix* there are but three such bristles. The wings are also not obviously brown on the apical halves, as is the case in the latter, and the facial carina is more prominent above and more distinctly sulcate.

Both species have a submedian ventral bristle on mid-tibia in male. The hypopygium is the same as in *jacatrix*, and the latter may be merely a colour-variety of *viridocana*, the latter name having priority. I consider *pubera*, Villeneuve, as possibly the same species.

Locality.—Upper Tongaat, Natal, November 1919 (C. N. Barker).

Strongyloneura villeneuvei, Curran.

This species is bright blue or blue-green in colour, with blackish apices to the abdominal tergites. It is rather similar

in structure to the preceding, having the face similarly carinate, and the fourth abdominal tergite in female without discal bristles. The wing is infuscated on costa, the dark mark interrupted just beyond the apex of first vein.

Besides the paratype which I have received from Mr. Curran, I have a female from Kwa Ibo River, Eket Distr., S. Nigeria, 16. vi. 1911 (*Capt. Humphrey*).

Strongyloneura viridaurea (Wiedemann).

This species-name has been used by various writers on Oriental Diptera, but it is absolutely certain several species are contained in the concept. Senior-White has sunk *Somomyia cæruleocincta*, Bigot, *S. sivah*, Bigot, and *S. versicolor*, Bigot, as synonyms of *viridaurea*. Suspecting from an examination of my material that there might be more than one species contained in the Bigot material I wrote to Mr. J. E. Collin regarding certain characters which I consider are of specific significance, and his reply convinces me that the three species above mentioned are not all the same, so they cannot all be synonyms of *viridaurea*. The species *sivah* belongs to Group C, having the lower calypter without a lobe on inner side. The lower calypter in both the other species is lobed, more strongly so in *cæruleocincta* than in *versicolor*; in the former, however, the mesopleural hairs and those on notopleural region are all dark, while in *versicolor* they are pale except a few about middle of the mesopleura, which are dark.

Mr. W. L. McAtee recently examined the type-specimen of *viridaurea* at my request in Vienna. It differs from the last two species above mentioned in having both of the scales at base of costa yellow, the others having the basal one black and the second one black or brown. Mr. McAtee also examined the type-specimen of *munda*, Wiedemann, and it agrees in those characters with *viridaurea*.

I hope to be able to borrow the type-specimen of *viridaurea* later and make an exhaustive examination of it to determine which of the species before me it is, or if I really have the species. At this time I consider I have the species from the Philippines and Java.

Group C.

This group contains the species which are most closely similar to *prasina*, Bigot, the genotype of *Strongyloneura*. Mr. Collin has kindly furnished me with some details of the type-specimen of *prasina* as follows: *Strongyloneura prasina*,

Big., has narrow thoracic squamæ (your *Strongyloneura* type), the bare costal sclerite at base of wing is yellow, and the fine hairs in notopleural depression and on pleura are pale. The type (a female) has a very distinctive last abdominal sternite (fig. 1). No hairs in hollow on underside of first vein. Postalar declivity bare. The hairs on facial orbits have been almost rubbed off in type, but there are indications that such hairs were at one time present.

I have seen no specimen which agrees with the above in all characters.

In the group under consideration the postalar declivity is bare in all species known to me, and in this respect the species differ from most of those placed in the other two groups, though in Group A all the species except *cupreo-viridis* have their hairs extremely short and difficult to distinguish except under a high-power lens and in a very good light.

I have before me a large number of species belonging to the group, and, though they are rather similar in general habitus, most of them possess characters that lend themselves to the distinction of the species quite readily. The group is met with in Africa as well as the Orient, but does not, so far as I am aware, extend to Australia. It is impossible for me to identify many of the already described species, because here, as in most genera, the characters which I make use of for the distinction of the species were ignored by the original describers, and any attempt to associate the specimens with printed descriptions is futile without a comparison of type-specimens with those in hand. I have but three species available to me in type-material and take this opportunity of presenting some data upon these which may serve to distinguish them further than they were in the original descriptions. Some of the species described herein as new may have been described before by other workers, but nothing is to be lost by redescribing them, and confusion may arise were they misidentified and erroneous identifications recorded here.

Strongyloneura nigrohirta, sp. n.

Male.—Head black, more reddish on the less chitinous portion above and in front of the haired area of cheeks; postocular orbits yellowish-grey dusted, frontal orbits similarly dusted, but as the dust descends on parafacials it becomes more silvery, lower part of parafacials shining black, the haired part of cheek shining and lightly grey-dusted; antennæ brown; palpi fuscous. Thorax dull metallic green,

with a coppery suffusion and grey dusting on dorsum, the presutural area with a pair of narrow submedian coppery vittæ; pleura more shining than mesonotum. Abdomen dark metallic blue-green, apices of the tergites coppery or purplish, the disc almost entirely bronzy blackish and quite densely brown-dusted, with no evident checkerings or vitta. Legs black. Wings smoky, darker, brownish fuscous, on entire length of costal portion. Halteres brownish yellow. Calyptræ brown. All hairs black.

Frons not as wide at narrowest part as third antennal segment, the inner orbital bristles long anteriorly, becoming shorter above, and discontinued above middle of frons. Inner vertical bristles well developed, outer pair not evident; parafacials a little wider than third antennal segment, with sparse, rather strong hairs; face with a rather broad, rounded, central carina on upper half, the antennæ at bases separated by about half the width of one antennal socket; antennæ not over half the length of face, third antennal segment about 1.5 as long as second; vibrissæ well above mouth-margin; cheek higher than length of antenna. Thorax with three pairs of well-developed presutural acrostichals, the posterior pair widest apart; postalar declivity bare. Abdomen slightly flattened above, fourth tergite with a median transverse series of fine bristles; hypopygium of moderate size. Bend of fourth vein broadly rounded. Mid-tibia without a median ventral bristle.

Length 8 mm.

Type, Kamuli Usoga, Uganda, 9 miles N.E. of Nile, 4000 feet, 18. xii. 1911 (*W. B. Gill*).

This species is readily distinguished from any known to me by the blackish dorsum of abdomen, and the entirely black-haired pleura, etc.

Strongyloneura pendula, sp. n.

Male and female.—Head fuscous, face and vibrissal region reddish testaceous, orbits, parafacials, cheeks, and occiput grey-dusted, interfrontalia brown; parafacial in female with a dark changeable mark opposite base of antenna, which is hardly distinguishable in the male; antennæ and palpi testaceous-yellow, third segment of former slightly browned apically in male, second and third segments largely darkened in female; cheeks pale-haired, a few dark hairs above in front. Thorax metallic green, with coppery reflections on dorsum, the mesonotum slightly whitish-dusted and quadrivittate anteriorly; mesopleura dark-haired, the other pleural

hairs pale. Abdomen coloured as thorax, but the dorsum except that of fifth tergite quite densely greyish-dusted and almost opaque, the dorsal vitta very faint; basal sternite and basal portion of second pale-haired. Legs black, femora coppery, tibiæ and bases of tarsi reddish. Wings with brownish clouding on veins apically and costally at apex of second vein. Calyptre whitish. Halteres yellow.

Frons of male at narrowest part not as wide as third antennal segment; frons of female about one-fifth of the head-width at vertex, widened anteriorly, both supraorbitals strong; face not carinate, antennæ close together at bases. Thorax with one pair of strong presutural acrostichals. Abdomen with discal bristles on fourth tergite in female which are much stronger than those at its apex, no discal bristles in male; fifth sternite in male projecting downward (fig. 3), the processes contiguous, separated by a linear split, their exposed surfaces without hairs, appearing dusted, and with a long bristle on each at outer basal angle. Both sexes with a ventral submedian bristle on mid-tibia. Bend of fourth vein broadly rounded, the first posterior cell with a rather long neck.

Length 8-9 mm.

Type, male, allotype, and one male paratype, Zomba, Nyasaland (*H. S. Stannus*).

I have seen no species, nor any description of one, in which the fifth sternite of the male is as here.

Strongyloneura tristis, Bigot.

The above species belongs to this group. It is distinguished from its allies by the black colour, with no conspicuous blue or green metallic shades present anywhere on the insect, the black palpi, pleural and cephalic hairs, and basal costal scales, the wide parafacials which are about twice as wide as third antennal segment, and the strong setulæ on the latter on their lower portions.

I recorded this species in a previous paper in this series.

Strongyloneura natalensis, Villeneuve.

This species, which I have already recorded, belongs here also. It is bright metallic blue-green in colour, and has the legs entirely black.

Strongyloneura lancifer, Malloch.

This species is very similar to *tristis* in colour, but in the male sex it is very readily distinguished by the presence

of a dense clump of lanceolate bristles on each side of the fourth visible tergite. This character is common to three described species, *fasciculata*, Villeneuve, *caudata*, Curran, and the present one. I have a very strong suspicion that all three names may refer to the same species, *fasciculata* being the prior appellation, but an examination of the types may be necessary to decide this.

Strongyloneura dubiosa, Villeneuve.

I have received a specimen of this species from Mr. C. H. Curran, which he assures me is identical with one so identified by Dr. Villeneuve.

It is a bright metallic-green species without thoracic vittæ, and the abdomen has a purplish dorso-central vitta, and apices to the tergites of the same colour. The face, cheeks except their posterior margins, antennæ, and palpi are bright orange-yellow, the cheeks and face being more or less obscured by yellow dusting. The femora are green, tibiæ and bases of tarsi tawny yellow, and apices of tarsi fuscous. Wings yellowish hyaline, with a brown cloud on costa over apex of second vein; both basal scales of costa yellow. Hairs on parafacials, cheeks, and pleura except the upper margin of mesopleura yellow.

Frons of male linear, parafacial in same sex not, or but little, wider than third antennal segment; antennæ separated at bases by a mere line. Acrostichals 1+2. Fourth abdominal tergite with strong median bristles, the series curved posteriorly in the middle so that there are no bristles on middle of disc; mid-tibia in male without submedian ventral bristle; fourth wing-vein with a broadly rounded preapical curve.

The male specimen described above is from Stanleyville, Belgian Congo, the type-locality, and, in addition to it, I have four specimens from Aburi, Gold Coast.

Strongyloneura buccata (Bezzi).

I have before me the type-specimen of this species, a female. It differs very slightly from the species described above and may really be the same as it. The only distinctions I can find lie in the colour of the hairs on the mesopleura, which are practically all black, and the presence of some black hairs on sterno-pleura in front of the anterior bristle which are lacking in the specimens of *dubiosa* I have seen.

All of the specimens that agree with the type are females and all are from Uganda. A male from the same region

does not differ from the male of *dubiosa*, but may not be the same species as the females just referred to. A good series of specimens of both sexes and dissection of the male hypopygia is essential to the clearing up of the question of specific identities here.

I am deferring the publication of my keys to the species of Groups B and C until I have an opportunity to examine the type-specimens of some species which I hope to obtain later. I have certain specimens identified by other workers, but only in the case of type-material is one sure that identifications are even approximately correct, as I place very little confidence in such specimens in this genus.

The types of the species of this genus described by me will be deposited in the British Museum after my work on the genus is completed.

In addition to the foregoing notes on *Strongyloneura*, I present below descriptions of two new genera of Cosmini, both monobasic.

In my previous notes on Rhiniinæ, presented in the last part but one of this series of papers, I omitted mention of a character which appears to me to be of subfamily significance. This consists of a bare glossy submarginal band on the upper occiput extending almost entirely across its width. The back of the head, or occiput, is generally shallowly concave and its fitting, as it does, rather closely over the front of the thorax is possibly responsible for the development of the bare undusted band referred to, but it is clearly not an abraded area, and has evidently been developed at some remote period in the evolution of the tribe. In Calliphorinæ the occiput is generally more convex and uniformly dusted, and quite regularly haired.

An additional distinguishing character is the total lack of fine hairs between the postocular ciliæ and eyes in Rhiniinæ and the presence of some hairs in a more or less continuous series in Calliphorinæ.

Genus MALAYOMYZA, nov.

This genus will run down to section 7 in my key to the genera of Cosmini in the paper above referred to, but it has the presutural acrostichal and dorso-central bristles of thorax well developed, and, though not conspicuous, they are quite distinct. This character removes the genus from the segregate containing *Cosmina* and *Eucosmina*, neither of which has these bristles distinct, and in comparing it with those

genera listed further on in the key we find that it is readily separated on frontal characters from *Thoracites*, B. & B., and runs to section 10, which contains *Strongyloneura*, Bigot. It is readily separated from that genus by the lack of forwardly directed bristles on the upper parts of the orbits in the female and the lack of parafacial hairs.

Genotype, the following species.

Malayomyza humeralis, sp. n.

Female.—Head black, anterior third of each orbit testaceous-yellow, the interfrontalia not yellow in front, face and cheeks testaceous-yellow, the latter with a large subquadrate central black mark extending from eye to lower margin, the orbits each with a grey-dusted spot near middle, and each parafacial with a similar median mark; upper occiput blackish, grey-dusted; antennæ and palpi testaceous-yellow. Thorax black, very slightly grey-dusted, the dorsum shining, and slightly æneous, without distinct vittæ, humeral angles, propleura, and a broad vitta along upper margin of pleura to wing-base testaceous-yellow. Abdomen black, basal two tergites testaceous-yellow, each with a black apical fascia, narrowest on first, and on that segment not carried over lateral curve. Legs testaceous-yellow, femora fuscous, tibiæ and tarsi darker than coxæ. Wings yellowish hyaline. Calyptræ and halteres yellow.

Head almost identical in shape with that of *Eucosmina* (q. v.). Thorax with 2+4 dorso-central bristles, the two anterior pairs of postsuturals short, one pair of distinct presutural, and at least the prescutellar pair of postsutural, acrostichals present; presutural area with at least four bristles, the anterior posthumeral present. Legs much as in the next-described species, the tibial bristles weak and short, two antero-ventral bristles on hind tibia. Wing as in *Eucosmina*, but the inner cross-vein more obviously beyond middle of discal cell.

Length 5 mm.

Type, Gombak Valley, Kuala Lumpur, Selangor, Federated Malay States, 18. x. 1921 (*H. M. Pendlebury*).

Both this genus and *Eucosmina* have the lower calypter narrow and rounded at apex.

Genus *EUCOSMINA*, nov.

This genus has most of the characters of *Cosmina*, Robineau-Desvoidy, to which it runs in my key to the genera

of Cosminini published in Part XIX. of this series. It is distinguished by the structure of the head, and the thoracic chaetotaxy as shown below:—

- | | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|
| <p>A. Vibrissal angle quite conspicuously produced forward, the parafacials distinct on their entire length, and the face not concave in profile, frontal orbits in female with several series of short setulæ laterad of the incurved inner marginal bristles, some of them quite strong and forwardly directed; two post-humeral bristles present, the anterior one quite close to humeral callosity, and laterad on the posterior one</p> <p>AA. Vibrissal angle not conspicuously produced forward, the parafacials almost invisible below middle, and the face pronouncedly concave in profile, frontal orbits in female bare laterad of the incurved bristles; anterior posthumeral bristle lacking</p> | <p><i>Cosmina</i>, R.-D.</p> <p>[gen. nov.
<i>Eucosmina</i>,</p> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|

Genotype, the following species.

Eucosmina vittigera, sp. n.

Female.—Head black, anterior third of frons, the face except a line on lower half of each facial ridge, cheek except a large submedian mark, and lower occiput testaceous-yellow, a conspicuous spot of white dust near middle of each frontal orbit and another near middle of each parafacial, occiput lightly grey-dusted; antennæ and palpi testaceous-yellow, third segment of former browned above; hairs on cheek mixed black and yellow. Thorax black, humeral angles, propleura, a small portion of pleura at bases of wing, and the coverings of both spiracles yellow; mesonotum and pleura grey-dusted, the former with five broad black vittæ, the outer one on each side on lateral margin; scutellum with traces of three dark marks, continuations of the mesonotal vittæ; humeral and pleural hairs yellow, those on mesonotum black. Abdomen black, yellow on first tergite and sides of second in front. Legs fuscous, coxæ and femora yellow, bases of tibiæ and of tarsi dusky yellow. Wings yellowish hyaline. Calyptæ and halteres yellow.

Frons at vertex fully one-fourth of the head-width; all four vertical bristles distinct; ocellar bristles divergent; each orbit opposite anterior ocellus about one-fourth as wide as interfrontalia at same point; frons at base of antennæ projecting as far as width of third antennal segment; parafacial at lower part of eye almost invisible from the side; arista plumose; cheek nearly one-third as high as eye.

Thorax with one strong and one very weak pair of prescutellar dorso-centrals and one pair of strong prescutellar acrostichals; propleura bare in centre; prosternum haired; scutellum with six marginal bristles and quite dense decumbent hairs. Tergites without any strong apical bristles. Fore tibia with one antero-dorsal and one posterior bristle; fore tarsi normal; mid-tibia with one ventral, one antero-dorsal, and three posterior bristles; hind femur with one preapical and antero-ventral bristle; hind tibia with one antero-ventral, two antero-dorsal, and two postero-dorsal bristles. Inner cross-vein a little beyond middle of discal cell; bend of fourth vein rounded, the tip of first posterior cell with a short neck.

Length 6 mm.

Type, Bukit Kutu, Selangor, Federated Malay States, 3500 feet, 12. iv. 1926, at light; paratype, Gombak Valley, Kuala Lumpur, Selangor, Federated Malay States, 17. x. 1921 (*H. M. Pendlebury*).

Type in British Museum.

LXII.—*The Status of some recently described Genera and Species of Snakes.* By MALCOLM A. SMITH, M.R.C.S., L.R.C.P.

WHEN working last year in the Natural History Museum at Vienna, I took the opportunity of examining a number of the types of the new genera and species of snakes that have been described from that institution of recent years. The conclusions I reached concerning them are so completely at variance with those of the author, that I feel it would be in the interests of science to record them. This is all the more desirable when so many of the specimens are without data as regards their origin, or are recorded—though through no fault of the author—as having come from regions remote from those in which they were certainly found.

The collection, I am informed, was an old and much neglected one left by the late Dr. Steindachner. Some of the labels dealing with the origin of the specimens have been lost; others have evidently got transposed in the course of time, and it is through accepting these as correct that the author has been misled in making many of his diagnoses.

The generic names *Elaphe* and *Coluber* used by me in this article are applied in their revised sense—they are the *Coluber* and *Zamenis* respectively of Boulenger.

My thanks are due to Dr. Otto Wettstein for allowing me to make a very complete examination of all the specimens mentioned herein.

Coluber walli, sp. n.

SB. Akad. Wiss. Wien, 1924, Bd. 133, p. 34.

This specimen of unknown origin, and now somewhat bleached, I identify as *Elaphe erythrura* (Dum. & Bib.), with which it agrees in all particulars. The tail is imperfect.

Pachyophis temporalis, gen. et sp. n.

SB. Akad. Wiss. Wien, 1924, Bd. 133, p. 49.

The specimen agrees in all particulars with *Lamprophis inornatus*, Dum. & Bib. The pupil, though somewhat dilated, is vertically elliptic, and not round as stated.

Mr. H. W. Parker has pointed out to me that *Boodon infernalis*, Günther (Cat. Sn. Brit. Mus. 1858, p. 199), is also identical with *Lamprophis inornatus*, and that Boulenger in his 'Catalogue' (vol. i. 1893, p. 330) has repeated Günther's error. The types of *B. infernalis*, which he has examined, have a typical *Lamprophis* dentition, and agree entirely with the original description by Duméril and Bibron (Erp. Gen. 1854, p. 464), and with the specimens identified as *L. inornatus* in the Museum collection.

Triænonopholis arenarius, gen. et sp. n.

SB. Akad. Wiss. Wien, 1924, Bd. 133, p. 50.

The specimen is considerably bleached, and its original markings are hardly distinguishable, but in dentition, bodily configuration, and scalation it agrees with *Lampropeltis*, Fitzinger. It is almost certainly *L. getulus getulus* (Linn.). See Blanchard, "Revision of the Genus *Lampropeltis*," Bull. U.S. Nat. Mus., no. 114 (1921).

Mike elegantissimus, gen. et sp. n.

SB. Akad. Wiss. Wien, 1924, Bd. 133, p. 51.

Is an example of *Psammophis condanarus* (Merrem).

Argyrogena rostrata, gen. et sp. n.

SB. Akad. Wiss. Wien, 1924, Bd. 133, p. 51.

This specimen, said to have come from the Argentine, is an example of *Coluber fasciolatus*, Shaw, from India.

Pseudouromacer lugubris, gen. et sp. n.

SB. Akad. Wiss. Wien, 1924, Bd. 133, p. 52.

The two large grooved fangs at the back of the maxilla have been overlooked, and in dentition and scalation the specimen has the characters of *Philodryas*, Wagler. It appears nearest to *P. æstivus* (Schlegel).

Nerophidion hypsirhinoides, gen. et sp. n.

SB. Akad. Wiss. Wien, 1924, Bd. 133, p. 53.

This specimen, said to have come from New Guinea, agrees in all essential details with *Glypholycus bicolor*, Günther, from Lake Tanganyika. It differs from the description in having two minute suboculars on each side separating the labials from the eye. The same condition, however, can be seen in a juvenile recently obtained by the British Museum, while in several other specimens in the Museum collection the pre- and postoculars extend well beneath the eye and almost touch one another.

Eminophis lineolata, gen. et sp. n.

SB. Akad. Wiss. Wien, 1924, Bd. 133, p. 55.

Is an example of the Indian *Trachischium fuscum* (Blyth).

Pseudoxenodon fruhstorferi, sp. n.

SB. Akad. Wiss. Wien, 1925, Bd. 134, p. 49.

Is an example of *Natrix nigrocinctus* (Blyth).

Sympeltophis ungaloides, gen. et sp. n.

SB. Akad. Wiss. Wien, 1925, Bd. 134, p. 52.

Is an example of *Xenopholis scalaris* (Wucherer).

Wallia inexpectata, gen. et sp. n.

SB. Akad. Wiss. Wien, 1925, Bd. 134, p. 53.

Is an example of *Platyplecturus madurensis*, Beddome.

Adiastema cervinum, gen. et sp. n.

SB. Akad. Wiss. Wien, 1925, Bd. 134, p. 54.

The dentition and scalation of this specimen are those of *Dinodon*, Dum. & Bib., but its specific identity is not so clear.

In the character of the rostral, in the keeled dorsal scales, and in the number of ventral shields it agrees with *semicarinatus*. Boulenger's statement in the 'Catalogue' (vol. i. p. 361), that the portion of the rostral visible above equals half its distance from the frontal, must be modified in the light of more recent material. In several specimens in the British Museum collection it equals only one-third of its distance from that shield, as is the case with the specimen in Vienna.

In coloration, however, the Vienna specimen is typical *rufozonatus*, there being 106 dark dorsal bars upon the body.

Coluber floweri, sp. n.

SB. Akad. Wiss. Wien, 1925, Bd. 134, p. 55.

The specimen is coloured as follows:—Pale yellowish-brown above, whitish below, and spotted irregularly all over with dark brown. It represents a colour-variety of *Elaphe oxycephala* (Boie) which has not yet been described. There are four examples of this form in the British Museum collection. Their coloration is quite distinct from that of the typical form, which is uniform vivid green above, and it is evident also that their pale coloration is not due to bleaching of the specimens, as I was at first inclined to think.

This colour-variety is so far only known from the Malay Peninsula, but not to the exclusion of the typical form.

Simotes smithi, sp. n.

SB. Akad. Wiss. Wien, 1925, Bd. 134, p. 58.

Is an example of *Oligodon cyclurus* (Cantor), which I now regard as a race of *purpurascens*.

Dakaria subpunctata, gen. et sp. n.

SB. Akad. Wiss. Wien, 1925, Bd. 134, p. 59.

The specimen, said to have come from Senegambia, agrees in every particular with Mocquard's description (1902) of *Idiophis vaillanti* from Madagascar.

Hypsirhina gigantea, sp. n.

Ann. Naturhist. Mus. Wien, 1923, Bd. 36, p. 163.

The specimen is of unknown origin. It agrees in every way with *Enhydryis bocourti* (Jan) from Siam and the Malay Peninsula.

LXIII.—*Notes on some African Derbidæ (Homoptera).*—II.*

By F. MUIR, Hawaiian Sugar Planters' Experiment Station,
Honolulu, T.H.

THE present notes are based upon material from three sources: first, and chiefly, from the Imperial Bureau of Entomology, through Dr. Guy A. K. Marshall; secondly, from the British Museum (Natural History), through Dr. W. E. China; and, thirdly, from the Durban Museum, through Mr. E. C. Chubb.

Besides the species represented in these collections, this opportunity has been taken to list all the known African species of Derbidæ, including those from Madagascar. While there may be one or two unknown to the writer, the list will be found fairly complete. Twenty genera and seventy-one species are listed, twenty-two of which are described as new. Of the seventy-one species nine are still unknown to the writer.

It is interesting to note that some of the earliest-known African Derbidæ came from Sierra Leone, and, thanks to the activities of Mr. E. Hargreaves, we still know more about this family from that locality than from any other part of Africa. Further collecting is bound to increase greatly the number of species and genera.

With our present limited knowledge, it is impossible to draw any conclusions as to geographical distribution. A few species (i. e., *Zoraida bohemani*, *Proutista fritillaris*) have a wide distribution in Africa, but so far none of them strays outside that continent. Elsewhere this family shows high endemicity, especially among islands.

In employing the male genitalia for specific purposes, only such parts as are available without dissection have been used; the ædeagus in some cases has not been figured and in others it is shaded, but in no case has it been dissected out.

DERBIDÆ.

CENCHREINI.

1. PHENICE, Westwood.

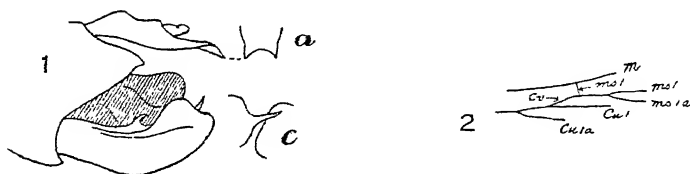
1. *Phenice stellulata* (Boh.). (Figs. 1, a, b, 2.)

Two males and three females from Sierra Leone, Njala, and Gendema (*E. Hargreaves*, ii., iv., vi. 1925), some on Nigerian oil-palm.

* For Part I. see *Ann. & Mag. Nat. Hist.* (9) xviii. 1926, pp. 227-240.

I take these to be this species, but only a comparison with the type will settle the question.

The clavus very narrowly open, joining *Cu* 1 *a*, which does not reach the hind margin. First median sector furcate



Phenice stellulata.

Fig. 1.—Left view of male genitalia: *a*, apex of anal segment; *c*, apices of genital styles.

Fig. 2.—Connection between *Cu* and *Ms* 1.

and appearing to belong to *Cu*. Lateral margins of pygofer angular; anal segments large, apex broad, truncate, with the lateral angles slightly produced. The apex of left genital style produced into a point and turned inward.

2. *Phenice 4-maculata*, sp. n.

Female.—Length 4.1 mm., tegmen 7.7 mm., wing 5 mm.

This species is quite typical of the genus; a small carina divides the vertex from the frons; no subantennal plate and the shoulder-keels are very small. Venation typical.

Anal segment slightly longer than broad, sides and apex slightly rounded; subgenital plate roundly produced from sides to middle of hind margin; the genital styles are fairly long.

Stramineous; the lateral portions of the pronotum slightly lighter than the rest, the mesonotum slightly sordid. Tegmina hyaline, stramineous, a clear area over the apical portions of costal, subcostal, and radial cells with a narrow triangular stramineous mark in middle, a clear triangular spot on hind margin between *Cu* 1 and first median sector extending between forks of first median sector. Veins stramineous. Wings fuscous, lighter over basal third, a dark fuscous or black band subparallel to apical margin cut into four spots by the lighter veins passing through, between the first and second black marks the white extending and making a distinct white spot.

Hab. GOLD COAST: Aburi (*W. H. Patterson*, 1912).

Described from one female specimen, which is very distinct on account of the black marks on the wing.

3. *Phenice fasciolata* (Boheman).

Derbe fasciolata. Boheman, 1837, Kongl. Vet.-Akad. Handl. pl. ii. fig. 3
(Sierra Leone).

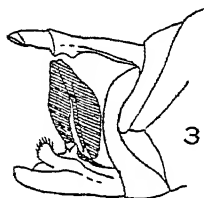
2. *CEDUSA*, Fowler.4. *Cedusa fusca*, sp. n. (Fig. 3.)

Male.—Length 2.3 mm., tegmen 3 mm.

The width of vertex at base more than twice the length, base considerably wider than apex. Shoulder-keel small, but quite distinct. Subantennal process longer than wide. Venation typical; in the two male specimens *M* 4 is missing.

The anal segment is long and slender; the apex is distinctive. The position of the anus, whether above or below the accessory piece at the apex, is uncertain.

Brown; the carinae of the head and thorax and the legs lighter; abdomen dark brown tinged with red. Tegmina



Cedusa fusca.

Right view of male genitalia.

brown or fuscous-brown, veins about the same colour. A small spot at node and the apical cross-veins whitish. Wings fuscous with darker veins.

In one specimen the head and thorax were uniformly light.

Female.—Length 3 mm., tegmen 4.6 mm.

In build and colour similar to the male; *M* 4 present.

The anal segment is similar to that of the male, but smaller; pregenital plate short at sides, long in middle, the hind margins produced angularly from the sides to middle, the apex in the middle rounded.

Hab. PONDOLAND: Port St. John, xi.-xii. 1923; ii.-iv. 1924. ZULULAND: Melmoth, iv. 1926; Eshowe, iv. 1926 (R. E. Turner).

Described from two males and five females.

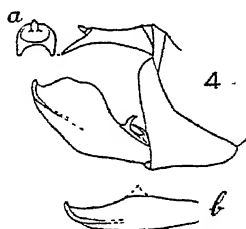
5. *Cedusa eshowensis*, sp. n. (Figs. 4, a, b.)

Male.—Length 2·6 mm., tegmen 3·8 mm.

Width of vertex about twice the length. Shoulder-keels very small and indistinct. There is a longitudinal swelling down the middle of the frons which at first looks like a carina. *M* with five apical veins—1, 1*a*, 2, 3, 4.

The anal segment comparatively small, in dorsal view sides subparallel to anus, which is in apical third; beyond anus the segment is turned slightly ventrad; apex emarginate, the corners subacute or rounded. In one specimen these apical projections are more acute than in the figure. In ventral view the genital styles slightly produced in the middle, in one specimen rounded but in others more angularly, apex pointed, short, and curved inward.

Stramineous; darker between the carinæ of frons and clypeus, lateral portions of pronotum below the subantennal plates, mesonotum, front legs, and abdomen. Tegmina



Cedusa eshowensis.

Right view of male genitalia: *a*, apex of anal segment; *b*, ventral view of left genital style.

light fuscous with slightly darker veins, a small dot at node and the apical cross-veins whitish. Wings light fuscous with darker veins.

Female.—Length 3 mm., tegmen 4·4 mm.

Similar in build and colour to the male.

Anal segment very short, apex angularly emarginate. The middle third of the hind margin of the pregenital plate truncate, the two lateral thirds oblique.

Hab. ZULULAND: Eshowe (*R. E. Turner*, iv.-v. 1926).

Described from three males and four females.

6. *Cedusa pondolandensis*, sp. n. (Fig. 5.)

In build and general appearance this is similar to *Cedusa eshowensis*, but the genitalia differ.

In the male the genital styles are longer, and in ventral view the middle is produced into a sharp spine and the apex into a long curved spine; the apex of the anal tube is also produced into two longer processes. In the female the



Cedusa pondolandensis.

Ventral view of left genital style.

pregenital plate has the hind margin angularly produced from sides to middle, the middle being fairly acute.

Hab. PONDOLAND: Port St. John (*R. E. Turner*, iv. 1923, i.-ii. 1924).

Described from one male and three females.

7. *Cedusa aburiensis* (Muir).

Herpis aburiensis, Muir, Ent. Mo. Mag. (3) iv. 1918, p. 236.

Originally described from one male from Aburi, Gold Coast.

Five males and five females from Sierra Leone, Njala (*E. Hargreaves*, 19. vi. 1925), and Sama (*E. Hargreaves*, 20. v. 1925) on Nigerian oil-palm. The female pregenital plate short at sides, the posterior margin produced angularly from sides to middle.

8. *Cedusa angustifrons* (Melichar).

Lamenia angustifrons, Melichar, Wien. Ent. Zeit. 1905, p. 285 (East Africa).

9. *Cedusa lactea*, Melichar.

Lamenia lactea, Melichar, Wein. Ent. Zeit. 1905, p. 284 (East Africa).

10. *Cedusa natalensis*, Muir.

Cedusa natalensis, Muir, Ann. & Mag. Nat. Hist. (9) xviii. 1926, p. 227.

3. PARAPHENICE, Muir.

Paraphenice, Muir, Proc. Ent. Soc. Washington, xxvi. (1), January 1924, p. 18.

Imbalara, Hesse, Ann. S. African Museum, xxiii. (1), October 1925, p. 155, pl. viii. figs. 1, 1 a.

So far four species of this genus have been described, and one more is now added. They have similar facies, and the

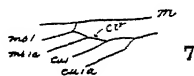
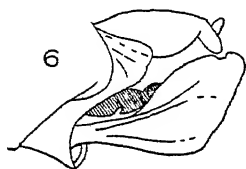
colour-pattern on the tegmina is difficult to describe adequately. The male genitalia must be the final court of appeal, and so it is necessary to describe or figure them. Descriptions without mention of the genitalia or without even mentioning the sex are useless.

11. *Paraphenice hargreavesi*, sp. n. (Figs. 6, 7, a.)

Male.—Length 3.2 mm., tegmen 5.2 mm., wing 3.6 mm.

Five median sectors, the first sector forked and appearing as part of the *Cu*. The anal segment is very distinct, wide, tectiform, with the lateral margins rounded, the apical portion is constricted off, and the anus is at the apex; genital styles bluntly pointed and turned inward.

Reddish brown, lighter stramineous over frons, vertex, antennæ, legs, and lateral portions of pronotum. Carinæ of thorax, the middle of abdominal tergites, and the anal segment lighter. Tegmina fuscous-brown with lighter hyaline markings, four of these in the costal cell and one at



Paraphenice hargreavesi.

Fig. 6.—Left view of male genitalia.

Fig. 7.—Connection between *Cu* and *Ms*1.

the apex of *Sc*, one at the base of *R* cell and another near the cross-vein, and two smaller marks in the apical *R* cell, one at apex of *M* basal cell and near fork of *Cu*, one on each side of the gradate cross-veins between median sectors and another nearer the base of the median sectors. *Sc*, *R*, and *M* veins light reddish or yellowish, other veins dark, a darker spot at fork of apical median sector. Wings hyaline, slightly fuscous with dark veins.

Female.—Length 3.4 mm., tegmen 6.5 mm., wing 4.2 mm.

Anal segment longer than broad, widest at base, gradually narrowing to the moderately rounded apex, which projects slightly beyond the angles of the ninth tergite; angles of the ninth tergite rounded, not produced into a point and, in lateral view, not emarginate.

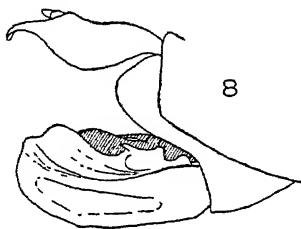
Described from four males and six females from Njala, Sierra Leone (*E. Hargreaves*, xi. 1926).

12. *Paraphenice neavei* (Muir).

Phenice neavei, Muir, Ent. Mo. Mag. (3) iv. 1918, p. 235.

One male and five females from Njala, Sierra Leone (*E. Hargreaves*, x.-xi. 1926).

This species was originally described from one male and one female from Mlanje, Nyasaland. It can be distinguished from *P. hargreavesi* by the shape of the female anal segment



Paraphenice neavei.

Right view of male genitalia.

and by the small projection and emargination on the ninth tergite in the female, by the male genitalia, and by the head being all light yellow, including the clypeus.

Imbalara squamifer, Hesse, appears to be very close to this species; the genitalia are not described and no mention of the sex is made, but the figure is of a female.

13. *Paraphenice squamifer* (Hesse).

Imbalara squamifer, Hesse, Ann. S. African Museum, xxiii. (1), 1925, p. 156, pl. viii. fig. 1, 1 a (South Africa, Ovamboland).

14. *Paraphenice sierraleonensis*, Muir.

Paraphenice sierraleonensis, Muir, Ann. & Mag. Nat. Hist. (9) xviii. 1926, p. 228, figs. 2, 3 (Sierra Leone).

4. *FESCENNIA*, Stål.15. *Fescennia bivittata* (Coquerel).

Phenice bivittata, Coquerel, Ann. Soc. ent. France, (3) vii. 1859, p. 258 (Madagascar).

Fescennia laticeps, Stål, Hem. Afr. iv. 1866, p. 199.

RHOTANINI.

5. *LEVU*, Kirkaldy.

16. *Levu africana*, Muir, Ann. & Mag. Nat. Hist. (9) xviii. 1926, p. 233 (Sierra Leone).

OTIO CERINI.

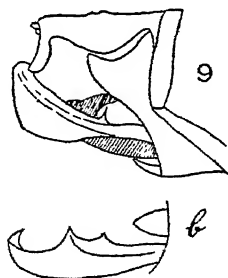
6. KAMENDAKA, Distant.

17. *Kamendaka (Eosaccharissa) pseudalbomaculata*, sp. n.
(Fig. 9.)

Male.—Length 2·4 mm., tegmen 4·5 mm.

The junction of frons and vertex making an angle of 90 to 100 degrees; apical portion of frons moderately curved.

Head, pronotum, and legs stramineous; the pronotum darker behind the eyes; mesonotum and abdomen darker brown; genitalia lighter. Tegmina fuscous with hyaline spots, which are sometimes opaquely white with waxy secretion, veins red. The white spots are as follows:—Three or four in costal cell running together on costa, four



Kamendaka pseudoalbomaculata.

Right view of male genitalia: 6, ventral view of left genital style.

in clavus, one near base and another at cross-vein of *R* cell, one in basal *M* cell, two in *Cu* cell, one between *Cu* fork, one between *Cu* and *Ms* 1, two between *Ms* 1 and 2, a larger spot at apex of *Ms* 2, a small one at apex of *Ms* 3, and small spots at apices of *Sc* and *R*. Wings fuscous with darker veins.

Genitalia figured; apex of anal segment curved ventrad, apical angles slightly produced.

Female similar to the male; the hind margin of the pregenital plate roundly produced from near the lateral angles to the middle.

Hab. SIERRA LEONE: Sama (*E. Hargreaves*, 20. v. 1925).

Described from two males and one female.

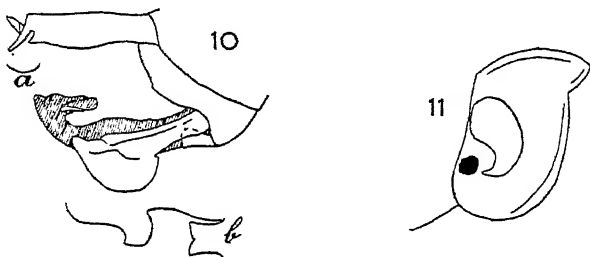
18. *Kamendaka (Eosaccharissa) ugandensis*, sp. n.
(Figs. 10, a, 11.)

Male.—Length 3 mm., tegmen 5 mm.

In profile the apex of venter and base of frons projecting forward; subcostal cell short.

The anal segment long, narrow; in lateral view there is seen a small notch in ventral margin near apex; the apex is rounded and the anus near apex. The medio-ventral process of pygofer is subquadrate, the apical margin with a small angular emargination.

Light stramineous; head lighter; abdominal tergites fuscous. Tegmina hyaline, slightly opaquely white, marked with light stramineous, one spot in clavus, one on *Cu* and one on *M*, a curved band from costa over fork of *Sc* and *R*



Kamendaka (E.) ugandensis.

Fig. 10.—Right view of male genitalia: *a*, apex of anal segment; *b*, inner margin of right genital style.

Fig. 11.—Profile of head.

and cross-vein of *R* cell, back over fork of *Ms* 1 and *Cu* to apex of clavus; the apical veins stramineous spreading into membrane, three small black dots at apex, one each in *R*, *M* 1 and 2 apical cells. Wings hyaline, opaquely white with waxy secretion, veins light. Like many other Derbidæ, they are often heavily covered with a white powdery secretion.

Female.—In build and colour similar to the male. The hind margin of the pregenital plate is broadly conical in outline, in profile the outline is concave, there appears to be a small swelling in the middle at the base and another at the apex.

Hab. UGANDA: Kampala (G. L. R. Hancock, vii., xi. 1926).

Described from six males and two females.

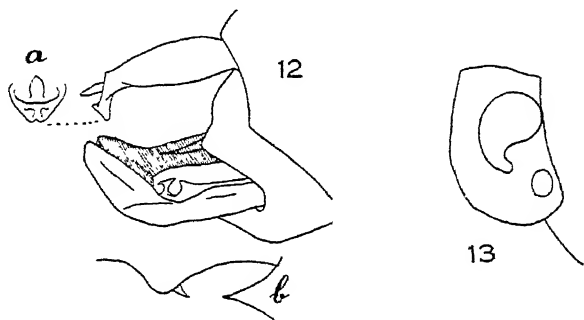
19. *Kamendaka (Eosaccharissa) hargreavesi*, sp. n.
(Figs. 12, a, b, 13.)

Male.—Length 2·8 mm., tegmen 4·4 mm.

In profile the junction of vertex and frons forming an angle of about 90 degrees, not projecting as in *ugandensis*. Venation typical, the subcostal cell short.

The genitalia figured; the apex of the anal segment beyond the anus turned ventrad with two small projections; the medio-ventral process angular; genital styles long, narrow, slightly curved upward.

Head, thorax, legs, and genitalia stramineous; abdomen fuscous, darkest on dorsum, pleura light; a slightly dark mark across genæ in front of eyes. Tegmina milky white



Kamendaka (E.) hargreavesi.

Fig. 12.—Right view of male genitalia: a, apex of anal segment; b, inner margin of right genital style.

Fig. 13.—Outline of head.

with waxy secretion, with fuscous-yellowish markings; one mark in middle of clavus, another over middle of stalk of *Cu*, one from hind margin at apex of clavus to *M*, an irregular mark from middle of costal cell, through middle of *R* cell, over base of second median sector to hind margin, fuscous over apical *Sc* and *R* cells, along apical cross-veins and over *M* apical cell; veins yellowish, showing light against the fuscous markings. Wings opaquely white with light yellow markings.

Female.—In shape and colour similar to male. Pre-genital plate short, middle half of hind margin roundly produced.

Hab. SIERRA LEONE: Njala (*E. Hargreaves*, v. 1927).

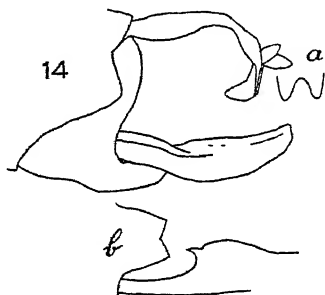
Described from one male and one female.

20. *Kamendaka (Eosaccharissa) minor*, sp. n.
(Figs. 14, a, b.)

Male.—Length 2.2 mm., tegmen 3.7 mm.

In shape of head, general build, and colour this species is very like *hargreavesi*. It is distinct by its size, slight difference in pattern on tegmina, and the genitalia.

The anal segment is long and thin, and the apical half is curved ventrad, the apex is emarginate. It is possible that the curve as figured is not quite normal, but due to some distortion. The lateral margins of pygofer are slightly curved, the medio-ventral process subquadrate, the apex is broadly, angulately emarginate and slightly narrower than the apex. The genital styles long and narrow, apex acutely pointed and curved inward.



Kamendaka (E.) minor.

Left view of male genitalia: a, apex of anal segment;
b, inner margin of right genital style.

There is a small black spot in middle of clavus, another near base between *Cu* and *M*, and a third slightly distad of the second between *M* and *Sc+R*. The rest of the markings are like those of *hargreavesi*, but not so distinct.

Hab. SIERRA LEONE: Njala (*E. Hargreaves*, iv. 1927).

Described from one male.

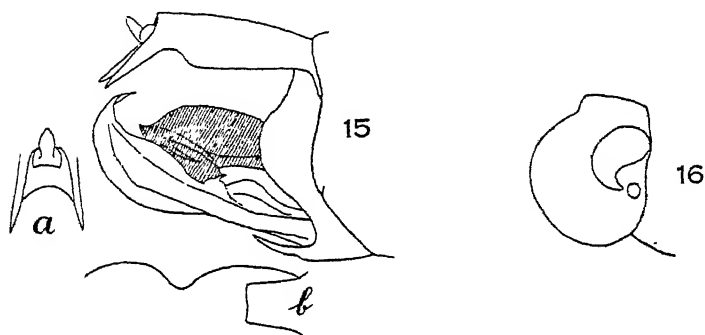
21. *Kamendaka (Eosaccharissa) straminea*, sp. n.
(Figs. 15, a, b, 16.)

Male.—Length 3 mm., tegmen 5 mm.

In profile the junction of frons and vertex forming an angle of about 90 degrees, slightly beyond the base the frons is curved, forming nearly half a circle. Venation typical, *Sc* cell short, *M* arising from *Sc+R* near base, four median sectors.

Apex of anal segment produced into two strong spines; lateral margins of pygofer curved; medio-ventral process subquadrate. The apex of genital style acutely pointed, curved inward.

Head, thorax, legs, anal segment, and genital styles stramineous, a darker yellowish band bordered with fuscous on dorsal margin across gena in front of eyes. Abdomen dark fuscous or brown, with yellow on pleura and hind margins of sternites. Tegmina light stramineous with hyaline spots, two or three in costal cell, a couple in clavus, three near together in basal half between *M*, *Cu*, and suture, larger areas between fork of *Cu*, between *Cu* and *Ms* 1 and *Ms* 1 and 2, one in basal half of *R* cell, some irregular



Kamendaka (E.) straminea.

Fig. 15.—Right view of male genitalia: *a*, apex of anal segment; *b*, inner margin of right genital style.

Fig. 16.—Outline of head.

marks in apical cells; veins light yellow. Wings white with light veins.

Hab. UGANDA: Kampala (*G. L. R. Hancock*, xi. 1926).

Described from one male.

There are two female specimens in the collection from Nyasaland, Mt. Mlanje (*S. A. Neave*), which represent two other species, but I refrain from describing them from females only. The genus is likely to contain a large number of African species.

22. *Kamendaka albomaculata*, Muir.

Kamendaka albomaculata, Muir, *Ann. & Mag. Nat. Hist.* (9) xviii. 1926, p. 230, figs. 4, 5, 6 (Sierra Leone).

7. PYRRHONEURA, Kirkaldy.

23. *Pyrrhoneura malanjensis*, Muir.

Pyrrhoneura malanjensis, Muir, Ent. Mo. Mag. (3) iv. 1918, p. 239 (Nyasaland).

8. ROBIGUS, Distant.

24. *Robigus tortrinotatus*, Muir.

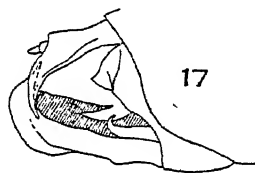
Robigus tortrinotatus, Muir, Ann. & Mag. Nat. Hist. (9) xviii. 1926, p. 231, figs. 7-11 (Nyasaland).

9. MYSIDIOIDES, Matsumura.

25. *Mysidioides africana*, Muir. (Fig. 17.)

Mysidioides africana, Muir, Ann. & Mag. Nat. Hist. (9) xi. 1923, p. 560.

This species was originally described from Nigeria. There are two male specimens from Sierra Leone, Njala (*E. Har-*



Mysidioides africana.

Right view of male genitalia.

greaves, vii. 1926, vi. 1927), from which the male genitalia are now figured.

10. PLATOCERA, Muir.

26. *Platocera africana*, sp. n. (Figs. 18, a.)

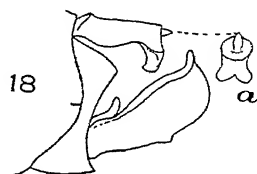
Male.—Length 2.6 mm., tegmen 6.7 mm., wing 4 mm.

In profile junction of vertex and frons slightly more angular than in the genotype. Antennæ large, longer than clypeus and frons together, flat, thin, closely and uniformly covered with sense-organs, margins slightly thickened. *M* leaving *R* where the first median sector arises.

Reddish brown; head, lateral portions of pronotum, carinæ and posterior margin of mesonotum, legs, and genital styles light brown or yellow. Tegmina hyaline, with light fuscous-brown markings, at the base a broad mark

over the nodal line where it is widest on the costal margin, over apical cells, and subapical distad of the third median sector; these dark areas contain small, clear, hyaline spots. Veins reddish brown. Wings hyaline, slightly fuscous, veins dark.

Anal segment much shorter than the genital styles; apex beyond anus turned ventrad; apex with a shallow angular



Platocera africana.

Left view of male genitalia: *a*, apex of anal segment.

emargination. The ventral margin of the genital styles concave on basal third, convex on apical two-thirds; about the middle and slightly before the middle the margin is developed into two small processes, which curve inward.

Hab. PONDOLAND: Port St. John (*R. E. Turner*, vi. 1923).

Described from one male specimen. This is the first of this genus to be recorded from Africa. The other four are from Amboina, Larat, Formosa, and British Guiana.

ZORAIDINÆ.

ZORAIDINI.

11. LYDDA, Westwood.

27. *Lydda elæidis*, sp. n. (Figs. 19, *a*.)

Male.—Length 3.2 mm., tegmen 6.9 mm., wing 2.3 mm.

Head as wide as or a little wider than the thorax, frons with lateral margins subparallel, not touching.

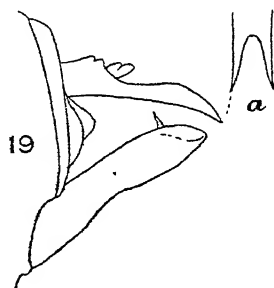
Lateral margins of pygofer bluntly angular; anal segment in lateral view nearly straight, apex deeply emarginate; genital styles nearly straight, the apical fourth thickened and produced into a strong spine on inner surface, basal three-fourths thin.

Yellow; dark brown on apex of labium, over sides of clypeus, in middle of frons; a few dark marks on abdominal tergites, abdominal sternites and bases of genital styles

dark; front and middle femora dark, a longitudinal black mark on first and second femora.

Tegmina and wings hyaline, slightly opaque with waxy secretion, veins dark brown.

Female similar to male; no distinct pregenital plate.



Lydda elæidis.

Left view of male genitalia: *a*, apex of anal segment.

Hab. SIERRA LEONE (*E. Hargreaves*, 21. vi. 1925).

Described from three males and one female off Nigerian oil-palm (*Elæis guineensis*, Jacq.). This is close to *Lydda lineatipes*, but specifically quite distinct.

28. *Lydda lineatipes*, Muir. (Fig. 20.)

Lydda lineatipes, Muir, Ann. & Mag. Nat. Hist. (9) xviii. 1926, p. 235.

This was described from a single female from Njala, Sierra Leone. We now have one male from the same locality (*E. Hargreaves*, 21. v. 1925), off oil-palm.

The lateral margins of pygofer slightly angular; anal segment curved ventrad, the apex deeply and angularly

20



Lydda lineatipes.

Ventral view of left genital segment.

emarginate; in lateral view genital styles nearly straight on outer margin, widest on basal half, which is slightly produced on inner margin; the inner surface about three-fourths from base produced into a strong short process; apically of this the style is cylindrical, basad it is flattened.

In colour similar to male.

29. *Lydda annetti* (Muir).

Diospolis annetti, Muir, Ent. Mo. Mag. (8) iv. 1918, p. 176 (Nigeria).

30. *Lydda cocos*, Muir.

Lydda cocos, Muir, Ann. & Mag. Nat. Hist. (9) xviii. 1926, p. 234, fig. 12 (Sierra Leone).

31. *Lydda woodi*, Muir.

Lydda woodi, Muir, Ann. & Mag. Nat. Hist. (9) xviii. 1926, p. 235 (Nyasaland).

32. *Lydda hargreavesi*, Muir.

Lydda hargreavesi, Muir, Ann. & Mag. Nat. Hist. (9) xviii. 1926, p. 236, figs. 13, 14 (Sierra Leone).

12. DIOSTROMBUS.

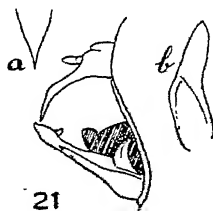
Diostrombus, Uhler, Proc. U.S. Nat. Mus. xix. 1896, p. 28.

Camma, Distant, Ann. & Mag. Nat. Hist. (7) xix. 1907, p. 404.

For some time I have tried to keep these two genera apart. The absence or presence of mesonotal carinae was used as a character, but in many cases it was more a personal opinion as to whether they were considered as present or not; if held in one light they could be distinguished, if held in other lights they could not. It is therefore best to consider them as one genus.

33. *Diostrombus cocos*, sp. n. (Figs. 21, *a*, *b*.)

Male.—Length 2.1 mm., tegmen 6.1 mm., wing 2.1 mm. Three mesonotal carinae distinct, but small (*Camma*).



Diostrombus cocos.

Right view of male genitalia: *a*, apex of anal segment; *b*, ventral view of right genital style.

Reddish stramineous, mesonotum more sordid; the lateral portion of pronotum white or yellowish. A thin line down

the front and middle femora, all the front tibiae, the front and middle tarsi, and the apical segment of labium dark fuscous; a narrow band round the abdomen on the fifth segment, the portion on the tergite wider than that on the sternite. Tegmina hyaline, costal and subcostal cells slightly yellowish. *C*, *Sc + R*, *R*, and the cross-vein between *R* and *M* dark fuscous, slightly fuscous along hind margin of clavus, other veins stramineous. Wings stramineous; a small round dark mark in middle, the apical half of the hind margin bordered with fuscous; veins fuscous.

The genitalia figured.

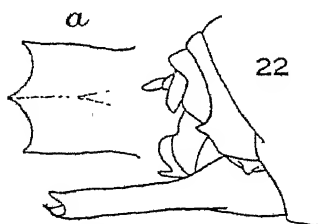
Hab. SIERRA LEONE: Njala, on coconut (*E. Hargreaves*, x. 1926).

Described from one male. This is closely related to *D. nitidus*, but is recognised by the black mark on the abdomen making a complete band, whereas in *nitidus* it is only on the ventral half.

34. *Diostrombus rufus*, sp. n. (Figs. 22, a.)

Female.—Length 3.1 mm., tegmen 6.9 mm., wing 2 mm.

Shiny red; the posterior part of pronotum and legs lighter, front and middle tibiae and tarsi fuscous. Tegmina hyaline, slightly tinged with stramineous; *Sc + R* and *R* thick, black, *Sc* and *M* stramineous, *Ms* and *Cu* brown, the entire margin bordered with very narrow fuscous, widest



Diostrombus rufus.

Right view of female genitalia: *a*, ventral view of apical portion of subgenital plate.

along claval and *Cu* margin. A small round spot in middle of wing and the hind fuscous.

The genitalia are very distinctive, the pregenital plate forms a large plate projecting well beyond the end of abdomen, which is best understood from the figure; it appears as if formed of two plates joined along the middle.

Hab. SIERRA LEONE: Njala (*E. Hargreaves*, x. 1926).

Described from one female. In colour this species is near to *grahami*, Dist., and *nitidus*, Muir, but the subgenital plate is nearer to *gowdeyi*, Distant.

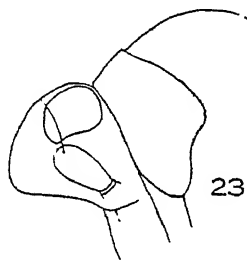
35. *Diostrombus hancocki*, sp. n. (Fig 23.)

Female.—Length 3 mm., tegmen 8 mm., wing 3 mm.

Mesonotum with three carinæ. Wings less than half the length of tegmina (1 to 2.6 mm.), the apex acute; tegmina with the basal median cell not very broad, the *Cu* not connected with *Ms* 1, *M* with six simple sectors; the *Sc* considerably convex and raised. In profile the frons subconically projecting; the median carina of clypeus strong, laterals weak.

The genital styles abortive; anal segment very short.

Head, legs, pronotum, the thoracic sternum, and most of



Diostrombus hancocki.

Left view of profile of head and pronotum.

the abdomen yellow. The apices of the front and middle tarsi, and the apex of proboscis, black; mesonotum shiny black, except a middle line and a small area on posterior margin which are yellow; scutellum black; the greater portion of three to six abdominal tergites black, with small light marks in middle and at sides. Tegmina hyaline, veins yellow, a fuscous band across middle from costa between the bases of second and third median sectors to hind margin apical of *Cu*, darkest on costa and fading out towards hind margin; a small dark spot at fork of *Sc* and at base of *Rs*. Wings hyaline, fuscous across middle and along hind margin to apex.

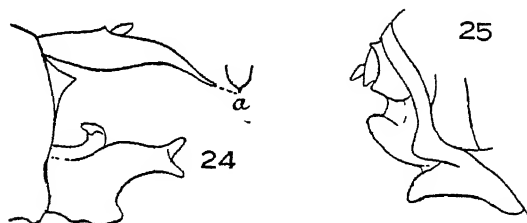
Hab. UGANDA: Naniulala Forest (*G. C. R. Hancock*, 27. x. 1925).

Described from one female.

36. *Diostrombus lanius* (Stål)? (Figs. 24, a, 25.)

Derbe lanius, Stål, Öfv. Vet.-Ak. Forh. 1855, p. 94.

There are one male and three females from Natal (*A. J*



Diostrombus lanius

Fig. 24.—Left view of male genitalia: a, apex of anal segment.

Fig. 25.—Right view of female genitalia.

Bevis) which I provisionally call this species. Lateral views of the genitalia are given for comparison with the type.

37. *Diostrombus dilatata* (Westwood).

Derbe (Phenice?) dilatata, Westwood, Ann. & Mag. Nat. Hist. (2 vii. 1851, p. 209 (Sierra Leone).

38. *Diostrombus biclavata* (Westwood).

Derbe (Phenice) biclavata, Westwood, Ann. & Mag. Nat. Hist. vi. 1841, p. 478 (Congo).

39. *Diostrombus abdominalis* (Distant).

Phenice abdominalis, Distant, Ins. Transv. 1907, p. 195 (Natal).

40. *Diostrombus lutea* (Muir).

Camma lutea, Muir, Ann. & Mag. Nat. Hist. (9) xviii. 1926, p. 239, figs. 17, 18 (Sierra Leone).

41. *Diostrombus apicalis* (Hagl).

Thracia apicalis, Hagl. Öfv. Vet.-Ak. Forh. 1899, p. 64 (Congo).

42. *Diostrombus grahami* (Distant).

Drona grahami, Distant, Ann. & Mag. Nat. Hist. (7) xix. 1907, p. 404 (Ashanti).

43. *Diostrombus gowdeyi*, Distant.

Diostrombus gowdeyi, Distant, Ann. & Mag. Nat. Hist. (8) xiii. 1914, p. 419 (Uganda).

44. *Diostrombus nitidus*, Muir.

Diostrombus nitidus, Muir, Ann. & Mag. Nat. Hist. (9) xviii. 1926, p. 237, fig. 15 (Sierra Leone).

13. *Proutista*, Kirkaldy.

45. *Proutista fritillaris* (Boh.).

Derbe fritillaris, Boheman, Kōngl. Vet.-Ak. Acad. Handl. 1838, p. 227, pl. vii. fig. 8.

Nine specimens from Njala, Sierra Leone (*E. Hargreaves*, v., vi. 1926). One male from Southern Bahr-el-Ghazal, Tambura, which is slightly lighter than the Sierra Leone specimens.

46. *Proutista tessellata* (Westwood).

Derbe (Phenice) tessellata, Westwood, Ann. & Mag. Nat. Hist. (2) vii. 1851, p. 209 (Sierra Leone).

47. *Proutista calami* (Melichar).

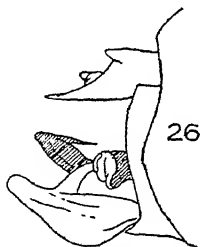
Phenice calami, Melichar, Ergeb. zweit. deutsch. Zentral Afr. Exp. i. 1914, p. 127, fig. 9 (Belgian Congo).

14. *Pamendanga*, Distant.

48. *Pamendanga hancocki*, sp. n. (Fig. 26.)

Male.—Length 4 mm., tegmen 10 mm., wing 4.6 mm.

The antennæ not quite so long as the frons. The apex of anal segment acute, lateral view of genitalia figured.



Pamendanga hancocki.
Right view of male genitalia.

Dark brown; vertex, frons, rostrum, and legs lighter; clypeus reddish; genitalia and some of the parts of the abdomen reddish. Tegmina dark fuscous-brown with a clear hyaline spot in middle extending from *M* behind third and fourth sectors to *Cu* along the cross-veins, another smaller clear spot at apex of *R* and *M*, a few light spots along costal cell, and a small light spot at the apex of each of the median

sectors and *Cu* veins. *Sc* and *R* veins reddish, other veins brown with red tinge. Wings fuscous-brown with darker veins.

Hab. UGANDA: Munga (*G. L. R. Hancock*, v. 1926).
Described from one male.

49. *Pamendanga nealei* (Distant).

Phenice nealei, Distant, Ann. & Mag. Nat. Hist. (8) xiii. 1914, p. 413 (Nigeria).

50. *Pamendanga majuscula* (Distant).

Phenice majuscula, Distant, Ann. & Mag. Nat. Hist. (8) xiii. 1914, p. 414 (Portuguese East Africa).

15. *HELICITA*, Stål.

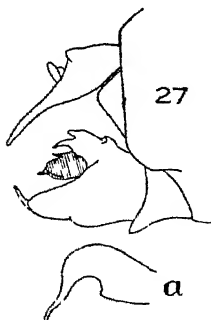
51. *Helcita occidentalis*, sp. n.

Helcita wahlbergi, Muir, not Stål, Ann. & Mag. Nat. Hist. (9) xviii. 1926, p. 238, fig. 16.

In the above-cited publication the writer reported *Helcita wahlbergi* from Sierra Leone, remarking that an examination of a male from South Africa was necessary before the identification could be definitely settled. A male specimen from Durban (*C. N. Barker*, 25. ii. 1917) now shows that the West Coast species is distinct. It is therefore named *occidentalis*. The male genitalia of *H. wahlbergi* are now figured for comparison. The markings on the tegmina of *occidentalis* are darker and more extensive than in *wahlbergi*.

52. *Helcita wahlbergi* (Stål). (Fig. 27.)

Derbe wahlbergi, Stål, Öfv. Vet.-Ak. Forh. 1855, p. 93 (South Africa).



Helcita wahlbergi.

Right view of male genitalia: a, ventral view of right genual style.

The male genitalia of a South African specimen are figured for comparison with the male of *H. occidentalis*.

16. RAIZODA, Muir.

53. *Raizoda signoreti* (Coquerel).

Deribia signoreti, Coquerel, Ann. Soc. ent. France, vii. 1859, p. 258, pl. vi. figs. 4, a, b.

17. ZORAIDA, Kirkaldy.

54. *Zoraida* (*Zoraida*) *bohemani* (Westw.). (Fig. 28.)

Derbe nervosa, Boheman (not Fabricius), Kongl. Vet.-Akad. Handl. 1837, p. 226, pl. vii. fig. 2.

Derbe (*Thracia*) *bohemani*, Westwood, Tr. Linn. Soc. Lond. xix. 1842, p. 10, fig. 2.

Thracia varipennis, Walker, List Hom. Ins., Suppl. 1858, p. 98.

Zoraida varipennis (Walker), Distant, Ins. Transv. 1907, p. 196, pl. xix. fig. 13 a.

There is a series of both sexes from Njala, Sierra Leone, which agree with the original description and figures of Boheman that Westwood used as the type of his species.



Zoraida (*Z.*) *bohemani*.

Right view of male genitalia.

Female specimens in the British Museum from Rhodesia and the type-material of *Z. varipennis*, Distant, from Natal, belong to this species.

55. *Zoraida* (*Zoraida*) *sinuosa* (Boheman).

Derbe sinuosa, Boheman, Kongl. Vet.-Ak. Handl. 1837, p. 10, pl. ii. fig. 2.

Three female specimens from Sierra Leone, Njala (*E. Hargreaves*, xi. 1926, vi. 1927), which agree with the original description. The figure of the male genitalia was published in 1922 (Philippine J. Sci. xx. (3), p. 349, fig. 4).

56. *Zoraida* (*Zoraida*) *njalensis*, sp. n. (Fig. 29.)

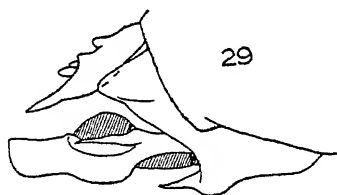
Male.—Length 3.4 mm., tegmen 8 mm., wing 4 mm.

In profile the frons slightly and roundly protruding; the frons narrow, the lateral carinæ touching except at base; antennæ much longer than frons, terete, thickly and uniformly covered with sense-organs. Venation typical, five median sectors, the first furcate and appearing as part of *Cu*;

the cross-vein between *Ms* 1 and 1 *a* is forked, making a small angular cell, which may be an aberration, but is on both the tegmina.

The genitalia figured; the apex of the anal segment has a small irregular emargination which does not appear to be natural; the sides are subparallel to the anus and then converging, forming a conical outline.

Fuscous-brown; the carinæ of head and thorax, and the minute granules on pronotum and abdominal tergites lighter; legs and anal segment lighter. Costal cell opaquely white; subcostal, radial, basal, median, and the basal portion of the cells between the median sectors, as well as the greater portion of the clavus, dark brown; the rest hyaline slightly fuscous; veins in the dark areas light tinged with red, the rest light; the apical margin and the tips of the fine veins ending in the apical margin white or yellowish. Wings hyaline, slightly fuscous, the anterior half slightly darker than the posterior.



Zoraida (Z.) njalensis.

Right view of male genitalia.

Described from one male from Njala, Sierra Leone (*E. Hargreaves*, 10. xi. 1926).

This species is near to *Z. nyasensis*, Distant, which was described from a female, but the protruding frons and the size, as well as slight differences in colour, are sufficient to separate them.

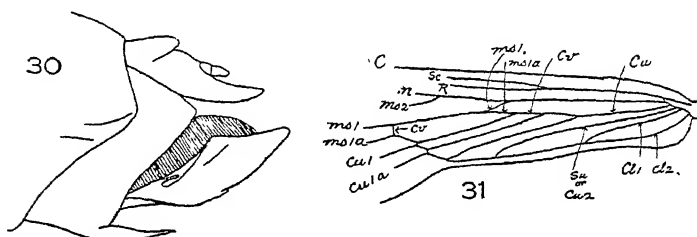
57. *Zoraida (Zoraida) fuligipennis*, sp. n. (Figs. 30, 31.)

Female.—Length 3.8 mm., tegmen 9.4 mm., wing 5 mm.

Antennæ terete, longer than the frons. Wings slightly more than half the length of tegmen; basal median cell long and narrow, *M* 1 appearing as if belonging to *Cu*. The length of the basal portion of tegmen, the clavus, and *M* basal cell correspond, if they be not correlated, with the length of the wing. The pregenital plate fairly large, sides about half the length of the middle, posterior margin subangular from sides to middle, the apex blunt or rounded.

Length of anal segment about 1.4 times the width, not reaching to the apex of ovipositor, broadest on basal half, then slightly narrowed, apex rounded.

Reddish fuliginous; antennæ, labium, and legs yellow; carinæ of head and thorax lighter, a number of small light dots on head and thorax, the abdominal tergites with small light dots slightly raised. Tegmina fuliginous; veins reddish, the median sectors less so, the apices of the veins entering the hind margin with a light mark, those entering apex bordered with light for a short distance; over the basal half and in *C*, *Sc*, and *R* cells a few minute light marks. Wings fuliginous with darker veins.



Zoraida (Z.) fuligipennis.

Fig. 30.—Left view of male genitalia.

Fig. 31.—Venation of basal portion of tegmen.

Male similar to female, but a little smaller. Genitalia figured. The apex of the anal segment bluntly rounded.

Hab. SIERRA LEONE: Njala (*E. Hargreaves*, iv. 1925, v. 1926).

Described from one female and one male.

58. *Zoraida (Zoraida) nyasensis*, Distant.

Zoraida nyasensis, Distant, Ann. & Mag. Nat. Hist. (8) xiii. 1914, p. 414 (Nyasaland).

59. *Zoraida (Zoraida) pattersoni*, Distant.

Zoraida pattersoni, Distant, Ann. & Mag. Nat. Hist. (8) xiii. 1914, p. 415 (Gold Coast).

60. *Zoraida (Zoraida) flavocostata*, Distant.

Zoraida flavocostata, Distant, Ann. & Mag. Nat. Hist. (8) xiii. 1914, p. 415 (Portuguese East Africa).

61. *Zoraida (Zoraida) picturata*, Distant.

Zoraida picturata, Distant, Ann. & Mag. Nat. Hist. (8) xiii. 1914, p. 416 (Nyasaland).

62. *Zoraida (Zoraida) evansi*, Distant.

Zoraida evansi, Distant, Ann. & Mag. Nat. Hist. (8) xiii. 1914, p. 416 (Gold Coast).

63. *Zoraida (Zoraida) aburiensis*, Muir.

Zoraida aburiensis, Muir, Ent. Mo. Mag. (3) iv. 1918, p. 229 (Gold Coast).

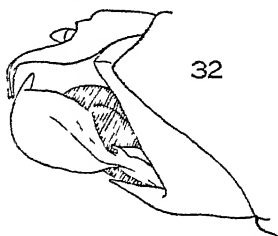
64. *Zoraida (Zoraida) fulgans*, Muir.

Zoraida fulgans, Muir, Ann. & Mag. Nat. Hist. (9) xi. 1923, p. 559 (Madagascar).

65. *Zoraida (Peggiopsis) distanti*, Muir. (Fig. 32.)

Zoraida distanti, Muir, Ent. Mo. Mag. (3) iv. 1918, p. 204.

This was described from two females, one from Kola River, Portuguese East Africa, and one from Natal. I have seen one female specimen from Sierra Leone, and now I



Zoraida (P.) distanti.

Right view of male genitalia.

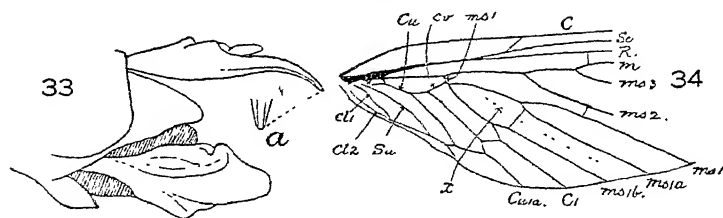
have one male from Natal belonging to the Durban Museum. The genitalia of this male are figured; the anal segment is drawn out into two fine processes and turned ventrad. The antennæ are distinctly flattened, but not so thin as in the more typical *Peggiopsis*, and the sense-organs are distributed evenly over the whole surface; the eyes are comparatively large and bulging. I originally placed this in the typical subgenus *Zoraida*, but now I move it into *Peggiopsis*.

66. *Zoraida (Neozoraida) ugandensis*, Dist. (Figs. 33, 34.)

Zoraida ugandensis, Distant, Ann. & Mag. Nat. Hist. (8) xiii. 1914, p. 416.

Three male specimens from Njala, Sierra Leone (*E. Hargreaves*, xi. 1926). This species was described from one female from Uganda, and until the male from that region has been compared with these specimens there must be some uncertainty over this identification.

The *Cu* appears as six-branched; the basal or first median sector has four branches, and appears as part of the *Cu*. The other median sectors are single.



Zoraida (N.) ugandensis.

Fig. 33.—Left view of male genitalia: *a*, apex of anal segment.

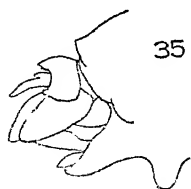
Fig. 34.—Venation of basal portion of tegmen

Male genitalia figured. The apex of anal segment is pointed.

67. *Zoraida (Neozoraida) maculicostata*, sp. n. (Fig. 35.)

Female.—Length 4.6 mm., tegmen 11.5 mm., wing 3.8 mm.

Vertex very small, triangular; frons very narrow; clypeus longer than frons, distinctly tricarinate. Antennæ distinctly longer than frons, slightly flattened. Mesonotum without carinae. The *Cu* appearing as with seven branches, the first, or basal, median sector with five branches joined to *Cu*; the second and third median sectors furcate. Wings one-third the length of the tegmina, apex rounded.



Zoraida (N.) maculicostata.

Right view of female genitalia.

Pregenital plate with a large projection in middle of the basal portion, posterior margin subangular. Anal segment small, conical in outline, apex not emarginate.

Stramineous slightly tinged with red, especially over the dorsal surface; a small fuscous V-shaped mark near base of abdominal dorsum. Tegmina and wings hyaline, slightly greenish opalescent, veins light. A series of minute black dots along the apical two-thirds of the costa of the tegmina.

Hab. SIERRA LEONE: Njala (*E. Hargreaves*, 17. ii. 26).

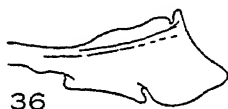
Described from one female.

68. *Zoraida* (*Neozoraida*) *carpenteri*, sp. n. (Fig. 36.)

Male.—Length 5·7 mm., tegmen 13·4 mm.; wing 4·9 mm.

In venation and general build similar to *Z. (N.) maculicostata*. Stramineous, lighter on ventral aspect; antennæ and anal segment tinged with red; a dark V-shaped mark at base of abdomen, the lateral portion of abdominal tergites fuscous. Tegmina hyaline, faintly sordid stramineous, the *C*, *Sc*, and *R* cells slightly opaque, veins same colour as membrane, most of the cross-veins light. A series of minute black dots along the apical two-thirds of the costa. Wings same colour as tegmina.

Lateral margins of pygofer angularly produced; the ventral margin angularly produced with the apex truncate. Anal segment long, narrow, very gradually narrowing to the pointed apex, anus slightly before middle. Genital style figured.



Zoraida (N.) carpenteri.

Right genital style.

Described from one male from Kigezi, Kivumbo District, Uganda (*G. D. H. Carpenter*, xii. 1920, no. 863).

This male is closely allied to the female *maculicostata*, from Sierra Leone, but its greater size, considering the sex, and different shade of colour of the tegmina make it highly probable that the male of *maculicostata* will show more distinct differences.

18. TEUTBERGA, Jacobi.

69. *Teutbergu anthracina*, Jacobi.

Teutbergu anthracina, Jacobi, Voeltzkow's Reise in Ostafri. iii. 1917, p. 532.

SIKAIANINI.

19. MUIRIA, Kirkaldy.

70. *Muiria pulchra*, sp. n. (Figs. 37, 38, a.)

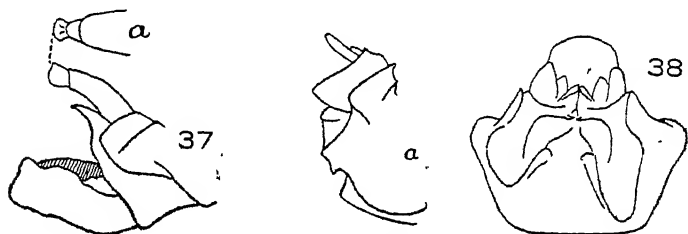
Male.—Length 2 mm., tegmen 4·5 mm., wings 2·2 mm.

Basal median cell not reaching to the middle of tegmen,

its length 5.5 times its width. Antennæ nearly as long as head and thorax together, slightly flattened, the arista about one-third from apex.

Lateral margins of pygofer produced to an acute angle beside the anal segment; the anal segment longer than wide, in dorsal view broad at base gradually narrowing to apex; genital styles longer than wide, the inner and outer margins slightly sinuate, subparallel, apex truncate, the outer apical angle slightly produced.

Stramineous; antennæ, clypeus, and labium fuscous, legs slightly fuscous, a slightly fuscous mark on pronotum behind eyes; abdomen fuscous ventrally, the dorsal aspect mottled with fuscous. Tegmina hyaline, clear, semiopaline, with a number of black marks; the largest mark between first and



Muiria pulchra.

Fig. 37.—Right view of male genitalia: *a*, apex of anal segment, dorsal view.

Fig. 38.—Full view of female genital area: *a*, right lateral view of same.

second median sectors, the next at apex of clavus; the cross-veins inclosed between two faint fuscous semicircular marks; faint fuscous marks at apices of *Cu* and *M* veins; the apical cells fuscous. Wings hyaline with a few small black marks.

Female.—Length 2.1 mm., tegmen 5.7 mm., wing 2.7 mm.

Similar to the male, but the marks on the tegmina are more distinct and darker. The genital area figured; it is peculiar and complex.

Hab. SIERRA LEONE: Njala (*E. Hargreaves*, 24. v. 1926, 27. vi. 1927).

Described from one male and one female.

20. *Sikaiana*, Distant.

71. *Sikaiana africana*, Muir.

Sikaiana africana, Muir, *Ann. & Mag. Nat. Hist.* (9) xviii. 1926, p. 240 (Gold Coast).

LXIV.—*Size-differences in the little "Pichi" Armadillos.*

By OLDFIELD THOMAS.

A STUDY of the skulls belonging to the little "Pichi" armadillo (*Zaedyus pichiy*, Desm., till recently known as *Dasybus*, *Euphractus*, or *Zaedyus minutus*, Desm.) shows that these present but little individual variation in size, while even the sexual difference is but slight. Females may be 2 or 3 mm. shorter than males—a difference little perceptible in a series.

But with regard to locality, while the skulls from the eastern and southern parts of the general range are all comparatively large, those from the north-west (Mendoza) are decidedly smaller, to a degree worthy of being subspecifically recognized.

Azara's "Tatou septième, ou Tatou Pichiy," on which all the existing technical names are based, was described as "inhabiting the Pampas to the south of Buenos Ayres, from 36° S. to Patagonia." Consequently some specimens from Bonifacio, Southern Buenos Ayres Province, about 37° S., presented to the British Museum by Colonels Porteous and Morley Knight, may suitably be considered topotypical of Azara's animal.

These specimens, in the size of their skulls, are at or near the maximum found in the genus, measuring about 68 mm. in length by 42 mm. in breadth, others from Chubut and Santa Cruz Provinces agreeing essentially with them. The largest male skull is 70 × 44 mm., but all intermediate sizes are represented. A female skull is 66 × 42 mm.

Contrasted with these dimensions a male skull from Mendoza is only 63 mm. in length and a female 62, females from San Rafael are 63 and 62 mm., while yet two others from the last-named localities, with imperfect rostra, are obviously of the same small size. There is evidently, therefore, a small race inhabiting the Province of Mendoza, and this might be termed

Zaedyus pichiy caurinus, subsp. n.

Essential characters as in true *pichiy*, but size smaller, as indicated by skull-measurements. Muzzle shorter in proportion to the size, and especially to the zygomatic breadth of the skull, its length in the type only 38 mm., as compared with upwards of 43 mm. in *pichiy*.

Dimensions of the typical skull:—

Greatest length 64 mm.; condylo-basal length 63; zygomatic breadth 41; tip of muzzle to back of postorbital projection 38; palate-length 35.

Hab. Mendoza Province; type from near Mendoza itself.

Type, old male in spirit. B.M. no. 90.2.20.6. Collected during the cruise of H.M.S. 'Challenger,' in all probability by Lord George Campbell*. Presented by the Lords of the Admiralty. Eight specimens examined, as compared with fourteen of *Z. p. pichiy*.

LXV.—On an *Encyrtid* (*Leefmansia bicolor*, *gen. et sp. n.*) reared from Eggs of *Sexava* (*Orth.*) in the Dutch East Indies. By Dr. JAMES WATERSTON.

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IN his recent report on certain Locustidæ of the genus *Sexava*, Stål, as coconut pests in the Dutch East Indies ('Mededeelingen Instit. von Plantenziekten,' no. 72, Weltevreden, 1927), Dr. S. Leefmans figures (pl. x. figs. 1-8) a Chalcidoid reared from *Sexava* eggs, and describes what is known of its biology. In the present paper I am supplementing the notes and figures referred to with descriptions based on material kindly forwarded by Dr. Leefmans to the British Museum, where also the type of this new species is deposited.

CHALCIDOIDEA.

Family Encyrtidæ.

LEEFMANSIA, *gen. nov.*

♀.—*Head* transverse but long; eyes sparsely pilose, from above large; occiput narrow; fronto-vertex long, narrow, parallel-sided, ocellar triangle isosceles and acute; genal space well developed; toruli well down below the level of the middle of the genal space; scrobal impression broad, semicircular; mandibles bidentate, the teeth small, and with a broad truncated upper apical edge. Antennæ: six cylindrical funicular joints, club with three divisions. Scape normal, cylindrical.

* Cf. Campbell, Lord George, "Log-letters from the 'Challenger'" (3rd ed.), p. 460 (1877).

Thorax: mesonotal surface smooth; the flat scutellum shining, no trace of parapsidal furrows; axillæ somewhat remote; scutellar chætotaxy simple.

Wings fully developed, fore wings banded or clouded; the marginal vein not punctiform; distinctly longer than the stigmal, which, again, exceeds the short postmarginal.

Abdomen as long as thorax; ovipositor not extruded.

The body is partly metallic, but more largely non-metallic.

♂.—Similar to ♀; in antennæ the scape a little stouter than in ♀, and only the more proximal of the funicular joints cylindrical. In the fore wings the marginal is shorter and the band much reduced and fainter. Abdomen not longer than thorax.

This genus is easily recognized by the neurulation, smooth flat scutellum, head, and colour. It has affinities in rather diverse directions with *Chiloneurinus*, *Homalotylus*, and *Trichomasthus*, but is easily separated from all these by characters already referred to.

Genotype the following species:—

Leefmansia bicolor, sp. n.

♀.—Body and legs for the most part non-metallic pale yellowish or yellowish white. Abdomen blackish, with strong metallic reflections which are purplish laterally and more violaceous or violet-green dorsally. Thoracic notum clear reddish violaceous, with pleuræ and underparts generally paler.

In the antennæ the club and last two funicular joints pure white; first four funicular joints blackish brown; scape and pedicel clear yellowish, infuscated dorsally. Legs entirely pale.

Wings: fore wings with a small oblique radical spot and a large completely transverse cloud from about the apical third of the submarginal to the end of the neurulation. Distal margin of cloud strongly convex; the proximal edge straight or nearly so.

Length 1.6 mm.; expanse 3.1 mm.

♂.—Similar to the ♀. In the antennæ the club is blackish and the funicle banded or speckled, the joints being pale basally and blackish distally on the inner aspect. Scape and pedicel paler.

Cloud of fore wing much reduced and faint, appearing mainly below the marginal.

The dimensions of this sex are one-fifth less than in the ♀.

Length 1.3 mm.; expanse 2.5 mm.

both sexes there are occasionally to be seen submetallic tints on the smooth ochreous or honey-yellow thoracic shield.

Dr. Leefmans describes the eyes as "red." In spirit-herm the colour is dirty chocolate and the ocelli crimson.

Holotype, ♀, in British Museum.

Ambou (D.E.I.). Leefmans coll. 1925-6. Found also at Batjan Is., and already successfully introduced into Carak'elong.

An important controller of *Sexava*, destroying up to a maximum of 51 per cent. of the eggs laid in particular localities.

LXVI.--*The Non-Marine Mollusca of Sierra Leone.*

By M. CONNOLLY.

[Plate XVIII.]

It is not surprising that practically nothing has been written on the above subject. In the first place, hardly any collecting has been carried out in Sierra Leone since the first half of last century, and, in the second, it would naturally be supposed that the fauna under notice would merely consist of extensions up or down the coast of the ordinary West African shells.

To a large extent this is the case, but a collection made during the last three years by Professor D. B. Blacklock, of the Sir A. L. Jones Research Laboratory, Freetown, and kindly submitted by him to me for investigation, contains so many new species, as well as unexpected instances of the above-mentioned extensions, that it seems preferable to deal with it in a special article, rather than in a more general work.

In the following pages I include all species which I have been able to trace as recorded from Sierra Leone, but the list cannot be considered complete; practically no references to literature are given, as most of the older species are well known and their synonymy has long been established.

The types of the new species are in my collection.

Family Streptaxidæ.

Subfamily STREPTAXINÆ.

Genus EDENTULINA, Pfr., 1855.

Edentulina liberiana (Lea).

(= *pupula*, Morel.)

Hab. Sierra Leone: Kaiyima, Sandoh Chieftdom (*Blacklock*).

Recorded from many parts of the West Coast, but not, apparently, from Sierra Leone.

Genus *GONAXIS*, Taylor, 1877

Pilsbry * segregated *Eustreptaxis*, Pfr., as a subgenus, the larger African forms of *Gonaxis*, on the ground that Pfeiffer designated *nobilis*, Gray, as type of *Eustreptaxis* in 'Nomenclator.' It does not appear, however, that Pfeiffer designated the type in the 'Nomenclator'† or elsewhere, and the first to do so was Kobelt‡, who selected as type the South American *S. contusus* (Fér.), the genotype of *Streptaxis*; *Eustreptaxis* therefore becomes a synonym of *Streptaxis*, s. s., and is not available for the African shells, which is not greatly to be regretted as in our present lack of anatomical knowledge there seems to be no definite line of demarcation between the larger and smaller forms of *Gonaxis*, wherein certain species vary so much in size in the same brood that this feature alone can be of little sectional importance.

Gonaxis monroria (Rang).

(=*nobilis*, Gray, *blandingianus*, Lea, *reclusianus*, Petit, and *rimatus*, Pfr.)

Hab. Sierra Leone (in British Museum): Kaiyima; Lengikorro; Kafogo; Marema; Tombudu; Jiamia, Nimmi Yemma; Port Loko (*Blacklock*).

Rang's name, *monroria*, which was bestowed on immature heliciform shells of this species, has precedence of the better-known *nobilis* and others. Individual examples vary greatly in size, the dimensions of three out of a set from Kaiyima, all collected around the same palm-oil tree and probably from the same brood, being respectively:—

Alt. 21.1;	diam. maj. 20.1,	min. 15.2 mm.
„ 17.4;	„ 14.5,	„ 12.8 „
„ 13.3;	„ 12.4,	„ 10.3 „

Gonaxis maugeræ (Gray).

Hab. Sierra Leone (*Vignon*): Langranna; Jiamia; Marema; York Pass, about 1800 ft. (*Blacklock*).

A smooth glossy species, which has a small, sometimes hardly visible, parietal plait.

Gonaxis welwitschi (Morel.).

Hab. Sierra Leone: York Pass, about 1800 ft. (*Blacklock*).

A noteworthy extension to the northward of this rare species, which was described from Angola; it has a smooth edentulate shell, whose outer lip is sharply angulate in profile and slightly inflexed a short distance below the suture; the York Pass example agrees with the type in showing some scratchy microscopic spiral striation about the second and third whorls.

* Bull. Amer. Mus. N. H. xl. 1919, p. 177.

† 'Nomenclator,' pp. 15, 417.

‡ Jahrb. Nassau. Ver. Naturk. lxxiii. 1910, p. 144.

Gonaxis inermis (Morel.)*.

Hab. Sierra Leone (fide *Morelet*).

This is merely the top of a moderately large *Gonaxis*, but I have not been able to match its sculpture with that of any available to me from the neighbourhood.

Gonaxis troberti (Petit).

(=*leonensis*, Pfr.)

Hab. Sierra Leone (*leonensis*, Foxcroft); Panguma; Langranna; Kaiyima; York Pass; Marema; Boadjibu; Jiama; Majendoo; Sokurella; Port Loko (*Blacklock*).

In this species, as in the case of *monrovia*, there exists great variation in size alone, other features remaining unchanged, but in *troberti* it seems to be local, rather than general, and it is only from the Marema and Kaiyima districts that I have seen series of noticeably differing size from adjacent localities; I append average measurements of four series; intermediates hardly exist among the shells I have seen:—

Kaiyima, series i. ...	Long. 10·0, lat. 7·4 mm.
" " ii. ...	8·4, " 5·8 "
Panguma	7·2, " 5·1 "
York Pass	6·5, " 4·2 "

This is one of the few Streptaxidæ which is known to possess a denticulate aperture when immature; these early denticles appear to become absorbed as the shell increases in size, as in the case of two mature examples which have been broken up for examination, one showed no dentition on the early whorls and the other only the faintest trace of one vanishing denticle.

Gonaxis blacklocki, sp. n. (Text-fig. 1.)

Shell of moderate size, subrhomboid, thin, smooth, glossy, transparent, pale olivaceous. Spire not much produced, sides parallel, axis inclined backward, so that the first three whorls are situate on the back of the shell; apex obtusangular. Whorls $5\frac{1}{2}$, flattish, rather rapidly increasing, the first two smooth, remainder almost so, the sculpture consisting of extremely fine, faint, transverse striæ with faint traces of very fine, close, microscopic, spiral engraving; suture simple, shallow. Aperture subquadrate, rounded at the base, peristome scarcely thickened or expanded, columella weak, upper margin simple in the type, though occasionally extremely narrowly reflexed; dentition none.

Long. 8·5, lat. 6·0; apert. alt. 3·0, lat. 3·1; last whorl 7·3 mm.

Hab. Sierra Leone: Jiama (type); Langranna; Majendoo (*Blacklock*).

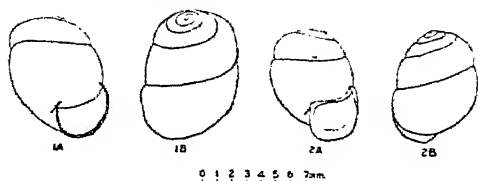
If we consider the extreme variation in size, with little in form or dentition, which occurs in *monrovia* and *troberti*, it appears

* *Helix inermis*, Morel. J. de C. xii. 1864, p. 157.

that the present species, which remains unusually constant in all these respects, is probably undescribed. It differs from *maugeræ* principally through the absence of the parietal plait and in having a comparatively shorter aperture, from *welwitschi* in smaller size and different shape of the outer lip, and from *prostratus*, Gld., in being far less prostrate, with a smaller rima.

Gonaxis pileolus, sp. n. (Text-fig. 2.)

Shell rather small, turbinate, rimate, thin, smooth, glossy, transparent, pale olivaceous. Spire not much produced, axis inclined backwards, so that the first three whorls are situate on the back of the shell; apex obtuse. Whorls $5\frac{1}{4}$, convex, gradually



Text-fig. 1.—Outline sketch of *Gonaxis blacklocki*, Conn. $\times 2$

„ 2.— „ „ „ „ *pileolus*, Conn. $\times 2$.

increasing, protoconch (two whorls) showing extremely faint, somewhat irregular, microscopical spiral scratches, remainder sculptured with coarse irregular growth-lines and, just below the suture, close, short, transverse puckers, while the whole surface is engraved with very fine, faint, close, microscopic spiral lines; suture simple, well defined. Aperture subquadrate, rounded at base, peristome hardly thickened, very slightly expanded, columella straight, rima well defined; dentition none.

Alt. 7·7, lat. maj. 5·8, min. 4·8; apert. alt. 2·9, lat. 2·4; last whorl 6·3 mm.

Hab. Sierra Leone: Langranna (type); Majendoo (*Blacklock*).

Differing from the preceding species in squatter form and stronger sculpture, while *Gonaxis turbinatus* (Morelet), in addition to being twice the size of *pileolus*, has regular fine transverse costulation, a feature lacking from the group now under notice.

Subfamily PTYCHOTREMATINÆ.

Genus PTYCHOTREMA, Mörch, 1852

Ptychotrema ringens (H. Adams).

Hab. Sierra Leone (*E. Higgins*).

Not in the Blacklock collection.

Section ENNEA, H. & A. Ad., 1855.

Ptychotrema thompsonæ, sp. n. (Pl. XVIII. fig. 1.)

very pale olivaceous. Spire produced, sides parallel, apex bluntly rounded. Whorls 6, nearly flat, the first three regularly increasing, remainder nearly equal, practically smooth except for regular, microscopic, oblique beading in, or immediately below, the sutures of the last four whorls; suture shallow. Aperture quadrate, rounded at base, peristome glossy, white, reflexed, columella erect, principal dentition three-fold: a prominent parietal lamella; an inrunning plait nearly halfway down the outer lip, corresponding to an external groove which continues faintly round the last whorl as far as the columellar margin, and a small nodule halfway up the columella; far within the aperture, too, is a kind of secondary columella bearing two small nodules.

Long. 6·9, lat. 3·1; apert. alt. 1·2, lat. 1·5; last whorl 3·5 mm.

Hab. Sierra Leone: Langranna (type); Panguma (*Blacklock*).

Ptychotrema elegantulum (Pfr.) is perfectly smooth and glossy, with a simple suture; the apertural dentition consists of the usual parietal plait and a weak denticle on the outer lip; in *thompsonæ* the sutural beading is well marked, the denticle on the outer lip is stronger, and there is an additional tubercle on the columella.

I have the greatest pleasure in naming this new species after Mrs. Blacklock (Dr. M. G. Thompson), who accompanied her husband in many of his travels and most kindly assisted him in forming the present collection.

Ptychotrema glyptothauma, sp. n. (Pl. XVIII. fig. 2.)

Shell very small, subelliptical, flattened and concave at the base, rimate, silky, translucent, pale olivaceous. Spire not greatly produced, sides slightly convex, apex bluntly rounded. Whorls $6\frac{1}{2}$, moderately convex, almost equal after the first two, the first $1\frac{1}{2}$ practically smooth, remainder covered with regular, oblique, slightly curved costulae, of a thickness equal to half the distance between them, but narrowing and converging beyond the carina, until they almost coalesce around the exterior of the columella; suture sub-crenulate, well defined. Aperture nearly square, peristome broadly reflexed; immediately behind the peristome, about two-thirds down the outer lip, the base of the shell is surrounded by a very strong, acute carina, which continues almost to the columella; dentition four-fold; a strong, far-entering parietal plait; a small inrunning plait commencing near the top of the outer lip; a stronger one, starting from a small denticle on the centre of the margin of the outer lip, corresponding to a faint external groove which runs about two-thirds round the last whorl before merging in the carina; and a small tubercle nearly halfway down the columella; the base is concave within the carina.

Long. 4·4, lat. 2·2; apert. alt. 1·2, lat. 1·1; last whorl 2·4 mm.

Hab. Sierra Leone: Langranna (type); Majendoo (*Blacklock*).

I cannot trace any near relation to this peculiar little shell; the costulate sculpture combined with the strong carina and concave base are sufficiently distinctive. It is a remarkable fact that both of these features occur in *Gulella angolensis* (Nobre), but accord-

distant in his species, while there is no trace of sulcation or of dentition on the outer lip; under these circumstances it is impossible that the two species can be congeneric, unless Nobre's type is extremely abnormal or his diagnosis faulty.

Genus *GULELLA*, Pfr., 1856.

Gulella monodon (Morelet).

Hab. Sierra Leone: Langranna; Majendoo (*Blacklock*).

This seems to be the first recorded occurrence of this well-known West African species in Sierra Leone; its size is very variable.

Gulella dautzenbergi, sp. n. (Pl. XVIII. fig. 3.)

Shell very small, subovate, rimate, rather solid, glossy, semi-transparent, pale olivaceous. Spire not much produced, sides parallel, apex obtusely conoid. Whorls 7, nearly flat, the first four rapidly increasing, remainder almost equal, the first two practically smooth, remainder sculptured with regular oblique striæ, strong in and immediately below the suture and then almost invisible; suture crenulate, well defined. Aperture subquadrate, rounded at base, peristome expanded and reflexed, columella weak, inclined to the left, dental process single, a strong, short, inrunning plait on the paries, near its junction with the outer lip; callus white, conspicuous.

Long. 4.6, lat. 2.3; apert. alt. 1.0, lat. 1.0; last whorl 2.4 mm.

Hab. Sierra Leone: Panguma (type); Majendoo; Port Loko (*Blacklock*).

At first I suspected that this species might be a variety of *G. arthuri* (Dautz.)*, but comparison with the latter, in company with its author, convinced us that it is specifically distinct; it is a little more obese, with a more acute apex, than *arthuri*, and lacks a little tubercle on the outer lip, which is present in that species. I have much pleasure in naming it after the eminent French scientist.

Gulella titania, sp. n. (Pl. XVIII. fig. 4.)

Shell minute, acuminate-ovate, narrowly rimate, thin, rugose, transparent, pale vitreous olivaceous. Spire not much produced, sides convex, apex mammillate. Whorls $6\frac{1}{2}$, convex, gradually increasing, the first $2\frac{1}{2}$ smooth, remainder sculptured with fine, regular, rather distant, straight, nearly vertical costæ; suture deep, simple. Aperture triangular, narrowly rounded at base, peristome reflexed, dentition five-fold; a strong straight denticle at the left angle and a curved plait at the right angle of the paries; a broad blunt tooth rather more than halfway down the outer lip; a small denticle on the left centre of the base and

* *Mém. Soc. Zool. Fr.* iii. 1890, p. 127, pl. i. fig. 2.

a narrow blunt one on the columella, opposite to that on the outer lip.

Long. 3.4, lat. 2.3; last whorl 1.8 mm.

Hab. Sierra Leone: Langranna (*Blacklock*).

This beautiful microcosm is only comparable to *G. opposensis* (Preston), from South Nigeria, which is considerably larger, has two teeth on the outer lip instead of a single tabular one, and in which there is an extra horizontal denticle high on the columella instead of a vertical one on the paries, as represented in *G. titunia*.

Section MOLARELLA. Conn. 1922.

Gulella pangumana, sp. n. (Pl. XVIII. fig. 5.)

Shell extremely small, bluntly acicular, rimate, bleached in the type, but normally thin, glossy, transparent, pale vitreous olivaceous. Spire produced, very slightly tapering, sides straight, apex rounded. Whorls 6, rather flat, gradually increasing, the first smooth, second closely microscopically vertically striolate, remainder sculptured with regular, straight, vertical striae, which are twice as close and half as strong on the third whorl as on the later ones; suture simple, somewhat impressed. Aperture subquadrate, rounded at base, peristome scarcely expanded, dentition five-fold: a long parietal plait not far from the outer lip; a small denticle two-thirds down the outer lip; a smaller one slightly to the left centre of the base, and two more, of which the lower is the larger, about halfway up the columella.

Long. 3.8, lat. 1.5; apert. alt. 0.8, lat. 0.8; last whorl 2.2 mm.

Hab. Sierra Leone: Panguma (*Blacklock*).

A second specimen, rather shorter, has the peristome a little more expanded and the front of the body-whorl not quite so strongly striate as the two preceding it.

Family Zonitidæ.

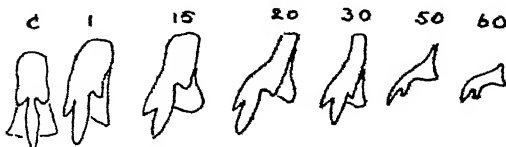
Subfamily HELICARIONINÆ.

Genus GRANULARION, Germain, 1912.

Granularion spatiosus (Preston)*.

Hab. Sierra Leone: Kaiyima; Tombudu; York Pass; Lengikorro (*Blacklock*).

Text-fig. 3.



Granularion spatiosus (Prest.), Kaiyima.

Representative teeth from the radula. $\times 400$.

* *Africarion spatiosa*, Preston, P. Z. S. 1914, p. 789, pl. ii. fig. 17.

Animals from Kaiyima and Tombudu have been examined by Hugh Watson and pronounced by him to belong to *Granularion*; I cannot separate their shells from that of *spatiosus*, though in this family, where identification usually depends on the anatomy, they may subsequently prove to be quite distinct. I am much indebted to Col. Peile for kindly figuring the radulæ of this and other species in this paper; in the present case the formula is $38.25.1.25.38 \times (93 + N)$.

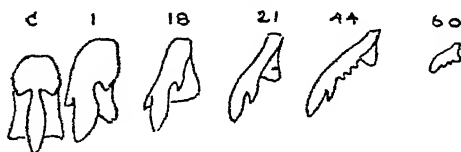
Genus *GYMNARION*, Pilsbry, 1919.

Gymnarion grandis (Beck).

Hab. Sierra Leone: Kaiyima; Yomadu, Sandoh Chiefdom; Tombudu, Kamarra Chiefdom; Yaradu, Bensey Chiefdom (*Blacklock*).

This fine species appears to be rare in modern collections, and its rediscovery is of value in determining, to a large extent, our knowledge of its distribution. The shell shows on the $1\frac{1}{2}$ embryonic whorls strong, continuous, close microscopic spiral lines, which agree in all respects with the sculpture of examples identified by Pfeiffer in the British Museum, and all the series from these

Text-fig. 4.



Gymnarion grandis (Beck).

Representative teeth from the radula. $\times 230$.

four localities, although mostly in splendid preservation, seem to be destitute of spiral sculpture, under 50-fold magnification, on the later whorls. Watson has kindly examined the animal and radulæ, which proves the species to be a *Gymnarion*, while he reports as to the radulæ that the specimens from Tombudu and Yomadu differ slightly from others in having the outer edges of the bicuspid marginal teeth more distinctly serrated than in the others, but he can attach no importance to this difference, as in every other way the animals seem to agree.

Colonel Peile has furnished the subjoined figure of the radula of a specimen from Yomadu; the formula is $45.18.1.18.45 \times (88 + N)$ and several lines of marginals are distinctly serrated (see No. 44).

Races closely allied to the foregoing were also collected at Kansagra, Gourama Chiefdom, Kruto, Sbirfe, and Kafogo. From Watson's report, the Kruto animals do not differ very greatly from those of the typical form, and I cannot separate the shells therefrom, but about the Kansagra specimens he writes that they differ in the radula having fewer marginal teeth, 36-38 instead of 46-48;

in the shell-lobes, especially the left one, being much shorter and in the animal being apparently of a whiter colour: the shells, however, are in poor condition, and I think it inadvisable to try to distinguish them from *grandis* without further material.

The remaining race appears worthy of at least subspecific rank.

Gymnarion grandis sbirfeensis, subsp. n.

Shell of moderate size, subglobose, narrowly umbilicate, thin, moderately glossy above, transparent, corneous, pale brown. Spire but little exerted, apex rounded. Whorls $3\frac{1}{4}$, moderately convex, rapidly increasing, protoconch, $1\frac{1}{4}$ whorl, microscopically sculptured nearly to the apex with very close, strong, continuous, hardly wavy, incised spiral lines, which continue more faintly on the succeeding whorls as engraved zigzag waves, but become scarcely visible nearing the aperture and on the base: the transverse striation consists of coarse, fairly regular growth-wrinkles: suture simple. Aperture suboval, peristome simple, acute, outer lip not ascending, curved backwards to the base, columella straight, erect, upper margin narrowly reflexed, nearly covering the minute umbilicus.

Diam. maj. 13·2, min. 10·0; alt. 7·5; apert. alt. 6·9, lat. 8·5 mm.

Hab. Sierra Leone: Sbirfe (type); Kafogo (*Blacklock*).

The radula differs from the others in the outer marginal teeth being distinctly narrower and longer. The number of the teeth and the form of the shell-lobes are both intermediate between what we find in the Kansagra snails and the rest, and the part of the skin that lines the shell shows more markedly contrasted white and dark markings than in the other beasts.

The only point of difference between the shell now described and typical *grandis* is in the presence of the microscopical spiral sculpture nearly all over the surface, instead of its being confined to the protoconch, but this, together with those noted just above, seem to entitle it to subspecific distinction.

Genus TROCHOZONITES, Pfeffer, 1883.

Trochozonites bifilaris (Dhrn.).

Hab. Sierra Leone: Panguma; Langranna; Marema; Majendoo (*Blacklock*).

Trochozonites trifilaris, Dup. & Putz.

Hab. Sierra Leone: Panguma; Langranna; Jiamia; Lengikorro (*Blacklock*).

Trochozonites talcosus (Gld.).

Hab. Sierra Leone: Langranna; Jiamia; Jockibu; Kaiyima; Kafogo; Majendoo; Port Loko (*Blacklock*).

Trochozonites adansonix (Morel.).*Hab.* Sierra Leone: Jiamia; York Pass; Port Loko (*Blacklock*).*Trochozonites pilosus*, d'Ailly.*Hab.* Sierra Leone: Marema (*Blacklock*).

Genus SITALA, H. Adams, 1865.

Subgenus PROSITALA, Germain, 1915.

Sitala (Prositala) fernandopoensis, Germ.*Hab.* Sierra Leone: Panguma (*Blacklock*).

This species, described from Fernando Po, has not been previously recorded from the mainland, but it has also been collected at Bitze, Camerun, by Bates, and in the Toro District, Uganda, by A. O. Fisher.

Genus KALIELLA, Blanf., 1863.

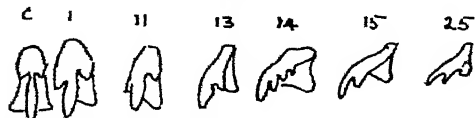
Kaliella barrakporensis (Pfr.).*Hab.* Sierra Leone: Jiamia (*Blacklock*).

Genus GUDEËLLA, Preston, 1913.

Gudeëlla columellaris (Pfr.).*Hab.* Sierra Leone: Jiamia; Sokurella; Kafogo; Port Loko (*Blacklock*).

This species appears to be unique among its confrères in the presence at the top of the columella of a prominent acute angulation, which projects over the rima; there is a pretty colourless variety from Port Loko. The radular formula is $26.11.1.11.26 \times (84+N)$, and line 14 on one side is abnormal, as shown in sketch.

Text-fig. 5.

*Gudeëlla columellaris* (Pfr.), immature, Sokurella.Teeth from the radula. $\times 400$.

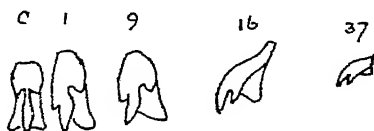
Another radula of this species shows a similar abnormality to that mentioned above, while a third has a line consisting of two admedians (Nos. 8 and 9), joined together.

Gudeëlla consueta, Prest.*Hab.* Sierra Leone: Marema (*Blacklock*).

It is impossible to affirm that these shells are actually identical

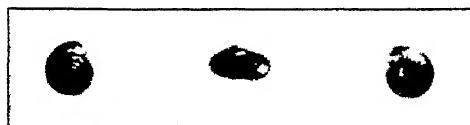
with Preston's species, but in sculpture and form they resemble it far too closely for me to venture to separate them. The columella is perfectly simple, leaving the narrow umbilicus open, and the microscopic spiral sculpture covers the shell all over, except at the extreme apex. The radula is figured below. the formula is $32.9.1.9.32 \times (64 + N)$, but there are probably some rows missing.

Text-fig. 6.

*Gudeilla consuetata*, Prest. ², Marema.Teeth from the radula. $\times 400$.*Gudeilla majendoensis*, sp. n. (Text-fig. 7.)

Shell of moderate size, depressed globose, narrowly umbilicate, thin, smooth, glossy, transparent, corneous, pale brown. Spire but little exerted, though each whorl is plainly visible above the next, sides regular, apex obtuse. Whorls $4\frac{3}{4}$, nearly flat, regularly increasing, microscopically sculptured all over, into the extreme apex, with very close, fine, continuous, delicately-waved spiral grooves, and after the protoconch ($1\frac{1}{2}$ whorls) with very faint, close, transverse wrinkles, which impart to the spirals a granulate appearance; suture simple. Aperture $\frac{3}{4}$ -lunate, rather flattened at base, peristome simple, acute, outer lip gradually receding to the base, columella inclined to the left, upper margin white, narrowly reflexed and obtusely inflexed at its upper extremity, thus overhanging, at that point, the umbilicus.

Text-fig. 7.

*Gudeilla majendoensis*, Conn. $\times 1$ (type in centre).

Diam. maj. 8.0, min. 7.2; alt. 4.1; apert. alt. 3.0, lat. 4.5 mm.

Hab. Sierra Leone: Majendoo (*Blacklock*).

The combination of spiral sculpture on the protoconch and the obtuse triangular inflexion on the top of the columellar margin are not found together in any species known to me; *Thapsia rufescens*, Pilsb., from the Ituri Forest, would appear to resemble it in some respects, but is only half its size, while in *columellaris*, Pfr., the projection is far more prominent, being sharply acute-angled,

instead of obtuse. The new species is also very near *Thapsiella nemorum*, Prest., which inhabits the forests north of Mt. Kenya, but the spiral sculpture on the early whorls seems to be a little finer and closer, and the umbilicus less open than in that species.

Family Pachnodidæ.

Genus CONTINTS, Mts., 1895.

Conulinus transvaalensis (M. & P.).

Hab. Sierra Leone: Panguma (*Blacklock*).

Genus RHACHIDINA, Thiele, 1911.

Rhachidina neurica (Rve.).

Hab. Sierra Leone: Jiama (*Blacklock*).

Family Achatinidæ.

Genus ACHATINA, Lam., 1799.

Achatina purpurea (Linn.).

Hab. Sierra Leone: Tombo (juv.); Kaiyima (variety with plain yellow shell, *Blacklock*).

Achatina balteata, Rve.

Hab. Sierra Leone: Freetown (*Brown*).

Achatina variegata, Roissy.

Hab. Sierra Leone: Freetown (*Brown*).

Genus LIMICOLARIA, Schum., 1817.

Limicolaria agathina, "Gabb," Pilsb.

Hab. Sierra Leone (in British Museum).

Limicolaria flammea (Müll.).

Hab. Sierra Leone: Freetown (*Brown*).

Limicolaria chromatella, Morel.

Hab. Sierra Leone (in British Museum).

Limicolaria kamboul (Brug.).

Hab. Sierra Leone (in British Museum).

Limicolaria numidica (Rve.).

Hab. Sierra Leone (in British Museum); Freetown (*Brown*).

Limicolaria obsoleta, Morel.

Hab. Sierra Leone (fide *Morelet*).

Limicolaria rubicunda, Shutt.

Hab. Sierra Leone (*Sir A. Kennedy*): Kissy (type, *Bossard*).

The last ten species are not in the Blacklock collection, but this is probably due to the fact that I particularly recommended Dr. Blacklock to concentrate on collecting the smaller and less known species, in the few moments of leisure which he could devote to Conchology, rather than to burden his luggage with the larger Achatinidæ, which are picked up and brought home by every naturalist who visits any of the African ports of call.

Limicolaria festiva, Mts.

Hab. Sierra Leone: Yaradu (*Blacklock*).

Limicolaria aurora (Jay).

(= *suffusa*, Rve.)

Hab. Sierra Leone: Tombudu; Port Loko, of a beautiful orange-red colour (*Blacklock*).

Limicolaria zebra, Pilsb.

Hab. Sierra Leone: Panguma; Jiamia; Kaiyima; Bambarra Town, Freetown; Lengikorro; Kafogo; Tombudu; Kent; Boadjibu; Port Loko (*Blacklock*).

In Pilsbry's Manual of *Limicolaria** he proved that the shell figured by Reeve † as *Bulimus turbinatus*, Lea, is not that species, and renamed it *Limicolaria felina*, Shutt., var. *zebra*, Pilsb. The shell above mentioned accordingly becomes the type of *zebra*; it is perfectly figured by Reeve in one of its numerous colour-patterns, and is widely distributed on the West coast, and as far inland as Uganda, but is quite distinct from *felina*, which is more fragile and obese, so that unless an older name can be found, that bestowed by Pilsbry holds specific rank. The prevalent colour-scheme in Sierra Leone is buff ground with rather broad dark brown flames, or a flesh ground with pale chestnut streaks, while unicoloured yellow examples have been collected in company with the above at Tombudu.

The two shells from Sierra Leone attributed in the Monograph ‡ to *tenebrica*, Rve., appear to belong to *zebra*.

Family Stenogyridæ.

Genus PSEUDOGLESSULA, O. Bttg., 1892.

Pseudoglessula leonensis, sp. n. (Pl. XVIII. fig. 6.)

Shell rather small, elongate turritiform, imperforate, fairly solid,

* Man. Conch. xvi. 1904, p. 266.

† Conch. Icon. v. 1849, no. 605.

‡ Man. Conch. xvi. 1904, pl. xix. figs. 9-10.

silky, translucent, dark corneous brown. Spire produced, sides straight, apex involute. Whorls 8, each successively decreasing in convexity, gradually and regularly increasing, the first involute, encircled above by a blunt ridge, nearly smooth, remainder strongly ribbed with transverse costæ, which are vertical, rather close and comparatively weak on the second whorl, strong, vertical and wider apart on the third. 11 ribs being visible on the front, becoming thence a little oblique and very gradually more distant, there being respectively 13, 14, 12, 15 and 15 costæ visible on the face of the last five whorls, of which the last is bluntly, but acutely, carinate at the periphery and almost smooth on the base: the spaces between the costæ are densely, very finely micro-punctate; suture simple, well defined. Aperture acuminate-subovate, peristome simple, acute, outer lip scarcely receding, columella concave, abruptly truncate near the base, with a white callus which extends half across the paries.

Long. 9.0, lat. 3.9; apert. alt. 2.8, lat. 1.7: last whorl 4.4 mm.

Hab. Sierra Leone: Langranna (*Blacklock*).

The peripheral carination of the last whorl suggests that the shell is immature, yet the white columella and callus would appear to signify maturity: the ridged involute apex and rather evenly spaced costæ differentiate the new species from any known to me.

Pseudoglessula clavata (Gray).

Hab. Sierra Leone (*W. G. Clements*, in British Museum).

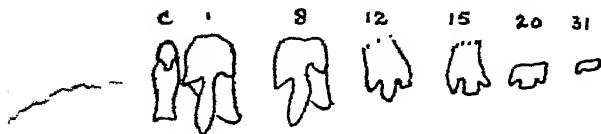
Genus GLESSULA, Mts., 1860.

Subgenus *Neoglessula*, Pilsb., 1909.

Glessula (*Neoglessula*) *lævigata* (Pfr.).

Hab. Sierra Leone: Panguma; Langranna; Kaiyima; York Pass; Kent; Jiama; Majendoo; Cape Lighthouse Peninsula; Port Loko (*Blacklock*).

Text-fig. 8.



Neoglessula lævigata (Pfr.), Jiama. Teeth from the radula. $\times 400$.

It is a little doubtful whether this species falls within the limits of *Neoglessula*, of which, if it does, it is on conchological grounds rather an aberrant member; but its radula resembles closely that of *N. paritura* (Gld.) as represented in the Gwatkin collection, while differing considerably from that of the Indian *Glessulae*. The formula is $23.8.1.8.23 \times (71 + N)$.

distinguishable under the microscope by the straightish distant costulae on the middle whorls and its truncate columella, but the spiral apical sculpture is so extremely faint that the species seems best placed in *Curvella*.

Genus *Pseudopeas*, Putz., 1899.

Pseudopeus egyptus, d'Ailly.

Hab. Sierra Leone: Panguma; Port Loko (*Blacklock*).

Pseudopeas chariesterum, Conn.

Hab. Sierra Leone: Panguma (*Blacklock*).

Originally described from Mt. Elgon, whence it is rather a far cry to Sierra Leone, but the Panguma shells vary somewhat between themselves in density of sculpture, and some approach the type of *chariesterum* too nearly for me to separate them.

Pseudopeas thompsonæ, sp. n. (Pl. XVIII. fig. 12.)

Shell very small, acuminate-ovate, narrowly rimate, thin, silky, semitransparent, pale olivaceous. Spire produced, sides slightly convex, apex narrowly rounded. Whorls 5, convex, regularly and rather rapidly increasing, the first 2 sculptured with extremely faint, close, microscopic spiral striae, remainder with moderately strong, slightly curved, vertical costulae, about two-thirds the thickness of the space between them; suture simple, deep. Aperture subovate, peristome simple, acute, outer lip evenly curved forward, columella straight and erect, margin almost adnately reflexed, so that the minute rimation is hardly distinguishable.

Long. 5.7, lat. 2.6; apert. alt. 2.3, lat. 1.0; last whorl 3.6 mm.

Hab. Sierra Leone: Jima (type); Panguma (*Blacklock*).

Two specimens only, the longest being selected as type; both are full of eggs.

Pseudopeas foliolum, sp. n. (Pl. XVIII. fig. 13.)

Shell small, elongate-ovate, narrowly rimate, thin, silky, transparent, pale olivaceous. Spire produced, sides nearly straight, apex mammillate. Whorls 6, not very convex, regularly increasing, the first $2\frac{1}{2}$ covered with strong, close, microscopic spiral striae, which continue far more faintly on the succeeding whorls, which are also sculptured with strong, close, regular, nearly straight, vertical striae, two-thirds the thickness of the space between them, and developing prominent lamellae, like short thick bristles, at the points where they are crossed by the spirals; suture simple, well defined. Aperture subquadrate, peristome simple, acute, outer lip very slightly curved in plan and profile, base narrowly rounded, columella straight, slightly inclined to the right, margin extremely narrowly reflexed, forming a small rima.

Long. 7.3, lat. 3.2; apert. alt. 2.7, lat. 1.5; last whorl 5.0 mm.

Hab. Sierra Leone: Jima (type); Langranna (*Blacklock*).

Notable for the wonderful leaf-like lamination on fresh specimens, which is soon worn off on weather-beaten shells. It is near to *Pseudopeas curvelliiforme*, Pilsb., from the Belgian Congo, but the latter shows no trace of lamination, is more slender, with greater arcuation in profile of the outer lip; the two species may, however, ultimately prove merely variably separable. *Ps. plebeium* (Morel.) is also nearly allied, but is perforate, shows no trace of lamination, and has rather more convex whorls.

Pseudopeas conspicuum, sp. n. (Pl. XVIII. fig. 14.)

Shell comparatively large, acuminate-ovate, very narrowly umbilicate, thin, silky, transparent, pale olivaceous. Spire produced, sides nearly straight, apex mammillate. Whorls 6, flattish, regularly increasing, the first 2 covered with close, strong, microscopic spiral striæ, which weaken on the next half-whorl, from which point the sculpture consists of strong, fine, rather distant, slightly curved, vertical costulæ, with extremely fine, faint, delicate, microscopic spiral striolæ in the intervals between them; suture simple, well defined. Aperture subovate, peristome simple, acute, outer lip very little outcurved, but moderately arcuate in profile, base rather narrowly rounded, columella inclined to the right, margin narrowly reflexed, but almost concealing the very narrow umbilicus.

Long. 11.1, lat. 5.0; apert. alt. 5.4, lat. 2.2; last whorl 7.3 mm.

Hab. Sierra Leone: Jiamia (type); Kafogo; Port Loko (*Blacklock*).

One of the larger forms of *Pseudopeas* and not particularly comparable with any known to me.

Genus SUBULINA, Beck, 1837.

Subulina normalis (Morel.).

Hab. Sierra Leone: Kaiyima; Langranna; York Pass; Panguma (*Blacklock*).

Subulina totistriata, Pilsb.

Hab. Sierra Leone: The Barracks (*Eudel*, 1852); Kent; Cape Lighthouse Peninsula; Port Loko (*Blacklock*).

Subulina subangulata, Putz.

Hab. Sierra Leone: Jockibu (*Blacklock*).

Family Succineidæ.

Genus SUCCINEA, Drap., 1801.

Succinea concisa, Morel.

Hab. Sierra Leone: Jiamia; Panguma (*Blacklock*).

Family Lymnæidæ.

Genus LYMNÆA, Lam., 1799.

Lymnæa undussumæ, Mts.*Hab.* Sierra Leone: Longo; Benikorro (*Blacklock*).

I list these shells under the above name, which is correctly applied to them, without venturing, for the present, into the difficult question of synonymy.

Family Planorbidæ.

Subfamily PLANORBINÆ.

Genus PLANORBIS, Geoffr., 1767 (*sensu lato*).*Planorbis adunsonii*, Gray, 1850.(=*coretus*, "Adanson," Dautz., 1890.)*Hab.* Sierra Leone: R. Njaia, Jiamia (*Blacklock*).

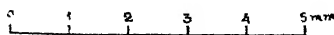
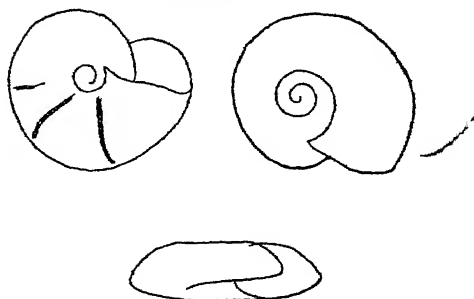
Shells from the above locality agree well with a paratype of *coretus*, Dautz., kindly presented to me by the author, and also with Adanson's original figure; I can confirm the correctness of the synonymy suggested by Pilsbry and Bequaert.

Genus SEGMENTINA, Flem., 1818.

Segmentina formosa, sp. n. (Text-fig. 9.)

Shell very small, discoid, umbilicate, thin, glossy, nearly transparent, corneous, normally greyish olivaceous, but in mature specimens, as in the type, encrusted with brown. Spire concave, sides

Text-fig. 9.

*Segmentina formosa*, Conn. ($\times 8$.)

slightly convex. Whorls 4, convex, rapidly increasing, carinate at the periphery, sculptured all over with close, regular, transverse

striae, curved in conformity with the outer lip, and close, regular, spiral grooves, which extend into the apex; suture impressed. Aperture barbate, outer lip curved slightly backward and then forward to the periphery, where it recedes greatly and is continued at right angles until joining the base at an interval from the umbilicus, which is wide and deep, extending to the summit and exposing all the whorls. There are three septae on the base of the last half-whorl.

Diam. maj. 3.1, min. 2.8; alt. 0.8 mm.

Hab. Sierra Leone: Boya River, Jiam (Blacklock).

A beautiful little shell, remarkable for its strong microscopic spiral engraving, which only seems to occur on one other African species, *kanisaensis*, Preston.

Subfamily *BULININÆ*.

(= *Isidorinæ*.)

There has never been any doubt that, if the species described and figured as "*le bulin*" by Adanson and subsequently named *Bulinus senegalensis* by Müller could be correctly identified from topotypes, the genus-name *Bulinus* would take precedence of either *Physa* or *Isidora*, and now that Pilsbry* has been able to determine the fact that the Podor shells belong to *Isidora*, Ehrenberg's genus can only be placed in synonymy, since there can be no possible grounds for maintaining distinction between them.

The two species in the Blacklock collection do not belong to the type-form of *Bulinus*, but to two different subgenera, so far as there can be any value in their subgeneric existence.

Genus *BULINUS*, Müll., 1781.

Subgenus *PYRGOPHYSA*, Crosse, 1879.

Bulinus (Pyrgophysa) forskali (Ehrn.).

Hab. Sierra Leone: Bai, Sutor-Bai and Soli, R. Sewi, Kaiyima (Blacklock).

Subgenus *PHYSOPSIS*, Krs., 1848.

Bulinus (Physopsis) cf. globosus (Morel.).

Hab. Sierra Leone: Panguma; Jiam; Paya; Jiamakorro; Kaiyima; Bendu; Benikorro; Kafogo; Sokurella; Lengikorro (Blacklock).

Blacklock, on my authority for its identification, has written two valuable articles† on the Sierra Leone *Physopsis* under the above name, and, in our present ignorance of the limitation and variation of local races of African water-snails, it is advisable to

* Bull. Amer. Mus. N. H. liii. 1927, pp. 132-135, 138-139.

† Report on Schistosomiasis, Sierra Leone, 1924, pp. 6-10; Trans. R. Soc. Trop. Med. Hyg. xviii. 1925, pp. 411-414.

retain it until more is known: however, in *globosus*, which extends across the continent from Angola to Delagoa Bay, the first $1\frac{1}{2}$ whorl, in very fresh and well-preserved shells, shows very faint spiral punctation, after which there is no sign of spiral sculpture, while in the series from Sierra Leone all show on the third and fourth whorls narrow microscopic spiral pathways, crossing the transverse striæ, and imparting to them a wavy appearance: the transverse striæ on the second whorl are very strong, close and continuous.

Owing to the spiral sculpture on the later whorls it may prove ultimately that the Sierra Leone race belong to some other species, or are undescribed, but much further study will be necessary before it will be possible to determine their exact status; they strongly resemble the figure of *Physopsis didieri*, R. & G.*, but *didieri* would appear to be imperforate and there is no mention in its description of spiral sculpture, whereas all Blacklock's shells are more or less perforate, like *globosus*, the principal feature which separates the latter from *africanus*, Krs.

Family Ancyliidæ.

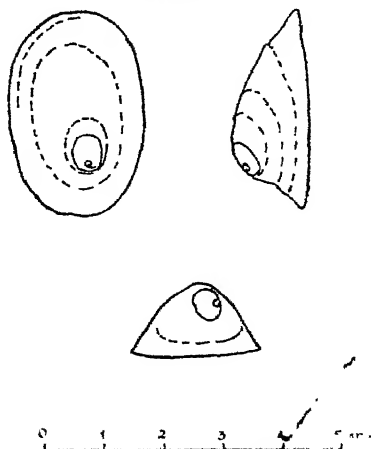
Subfamily FERRISSIINÆ.

Genus FERRISSIA, Walker, 1903.

Ferrissia leonensis, sp. n. (Text-fig. 10.)

Shell very small, patelliform, thin, silky, semitransparent, cor-

Text-fig. 10.



Ferrissia leonensis, Cc. m. ($\times 3$).

neous red-brown. Apex obtuse, a little inclined to the right but

* Mém. Soc. Zool. Fr. xvii. 1904, pl. i. figs. 6 & 7.

not projecting backwards, situate $\frac{1}{4}$ the length of the shell from the posterior end. The microscopic sculpture consists of very close, strong, regular concentric striæ, cut by slightly undulating radial grooves, which are strong and extremely close on the apex, becoming fainter and more distant as they radiate outwards and growing practically invisible on the anterior half of the shell.

Long. 3.6, lat. 2.5; alt. 1.6 mm.

Hab. Sierra Leone: Regent (type); Kissy Brook, Freetown R. Njaia, Jiama (*Blacklock*).

The form and dimensions of this species agree almost exactly with *Burnupia alta*, P. & B.*, from the Belgian Congo, but that is a *Burnupia*, and this is undoubtedly a *Ferrissia*. It must be near *F. chudeaui*, Germ.†, from Senegal, but the latter appears to differ from it in the far greater inclination of the apex, the concentric striation being more distant and irregular and the radial grooves considerably less numerous.

Family Cyclophoridae.

Genus MAIZANIA, Bgt., 1889.

Maizania leonensis (Morel.).

Hab. Sierra Leone (*Marche and de Compiègne*): Majendoo; Cape Lighthouse Peninsula; Port Loko (*Blacklock*).

The very simple corneous operculum serves to place this rather small species in *Maizania* rather than in *Chondrocyclus*.

Family Pilidæ.

Genus SAULEA, Gray, 1867.

Saulea vitrea (Born).

Hab. Sierra Leone: Makump Protectorate, on edge of marshy ground; Port Loko (*Blacklock*).

A most beautiful species, described from an unknown habitat, which remained practically unknown until rediscovered in considerable quantity in Liberia about forty years ago.

Genus AFROPOMUS, P. & B., 1927.

Afropomus balanoideus (Gld.).

Hab. Sierra Leone: Jiama; Panguma; Jockibu; Marema; Bambawuru (*Blacklock*).

Described from Liberia. The animals of both the foregoing species are to hand in spirit, and it is hoped that their anatomy will be published ere long.

* Bull. Amer. Mus. N. H. liii. 1927, p. 153, pl. xii. fig. 5.

† Bull. Mus. Paris, xxiii. 1918, p. 526.

Family Neritidæ.

Genus THEODOXUS, Montf., 1810.

Theodoxus æquinoxialis (Morel.).*Hab.* Sierra Leone: Port Loko (*Blacklock*).

Family Cerithiidae.

Genus POTAMIDES, Brongn., 1810.

Potamides fuscatus (Linn.)(=*radula*, Linn.)*Hab.* Sierra Leone: Kent (*Blacklock*).

PELECYPODA.

Family Driessenidae.

Genus CONGERIA, Partsch, 1836.

Congeria africana (van Ben.).*Hab.* Sierra Leone: Fishermen's Lake, near Bendu (fide *Schepmann*).

It will be seen from the foregoing pages, the first which have ever been devoted to the exclusive study of the molluscan fauna of Sierra Leone, that it has already been found possible to record 69 species from this comparatively small country, of which all but 11 are in the Blacklock collection, and 17 appear to be new to science, facts which promise extraordinary wealth of interesting material when it is found possible to carry out serious collecting in other little-visited countries of the West Coast of Africa.

EXPLANATION OF PLATE XVIII.

Fig. 1. *Ptychotrema thompsonæ*, Conn.Fig. 2. — *glyptothauma*, Conn.Fig. 3. *Gulella dautzenbergi*, Conn.Fig. 4. — *titania*, Conn.Fig. 5. — *pangumana*, Conn.Fig. 6. *Pseudoglessula leonensis*, Conn.Fig. 7. *Curvella blacklocki*, Conn.Fig. 8. — *insculpta*, Conn.Fig. 9. — *pangumana*, Conn.Fig. 10. — *langrannana*, Conn.Fig. 11. — *jiamana*, Conn.Fig. 12. *Pseudopeas thompsonæ*, Conn.Fig. 13. — *foliatum*, Conn.Fig. 14. — *conspicuum*, Conn.

LXVII.—*Some Parasitic Worms, mainly from Fishes, from Lake Tanganyika.* By H. A. BAYLIS, M.A., D.Sc.

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THE following is an account of the helminthological material obtained by Mr. S. R. B. Pask during Dr. C. Christy's collecting expedition of 1926 to Lake Tanganyika on behalf of the British Museum (Natural History). The collection of fishes was the main object of the expedition, and only a small proportion of the fishes obtained was examined for parasites. Of the species of worms collected, however, three appear to be new to science, and descriptions of these are included in the following notes. All the material was obtained at two localities—Kirando and Kigoma, both on the eastern shore of the lake.

NEMATODA.

Order ASCARIOIDEA.

Family Ascaridæ.

Dujardinia ? helicina (Molin, 1860).

Several larvæ, possibly belonging to this species (the adult form of which is parasitic in crocodiles), were obtained from the gut of *Lates microlepis*. They were of two very distinct sizes, and evidently represented two successive infections.

Order FILARIOIDEA.

Family Spiruridæ.

Rhabdochona paski, sp. n. (Figs. 1 & 2.)

A large number of specimens of this species was obtained from the pyloric cæca and intestine of a "Tanganyika salmon" (probably *Alestes macrophthalmus*) at Kirando. The same parasite is also represented in the collection by four females from a Siluroid fish obtained at Kirando, and a single incomplete male from a "small fish" captured at Kigoma harbour.

This form appears to be somewhat larger than any of the species of *Rhabdochona* hitherto described. The male measures about 15–20 mm., the female about 28–35 mm. in length, and the maximum thickness varies between 0.25 and

0.35 mm. The transverse cuticular striations are fine and indistinct, being about $7\ \mu$ apart in the female, in the middle region of the body. The diameter of the widest part of the "head" is 0.05–0.08 mm. The tail, in both sexes, is rather bluntly conical. That of the male measures about 0.3 mm. in length, that of the female 0.28–0.37 mm. The caudal end of the male is usually coiled into a close spiral, while that of

Fig. 1.

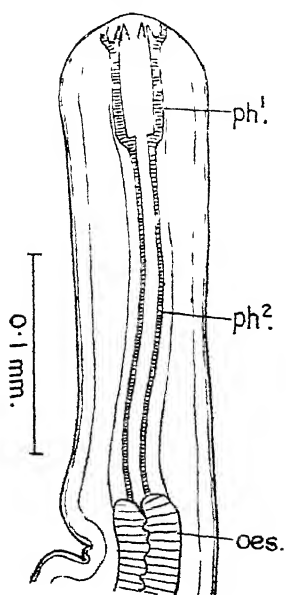
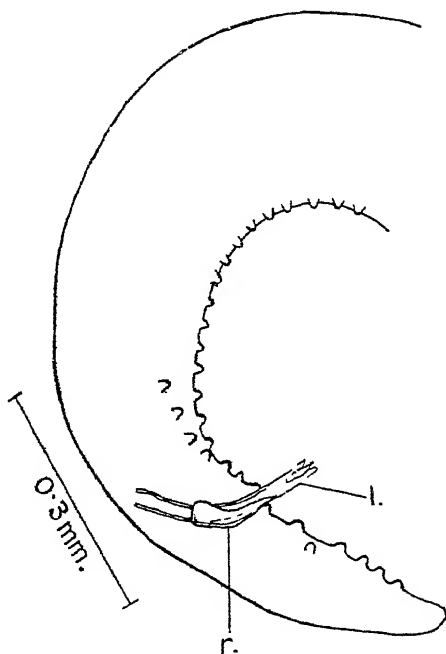


Fig. 2.



Rhabdochona paski, sp. n.

Fig. 1.—Anterior end of female. oes., oesophagus; *ph*¹, anterior chamber of pharynx; *ph*², posterior portion of same.

Fig. 2.—Posterior end of male, lateral view. *l.*, left spicule; *r.*, right spicule.

the female is straight. The distance from the anterior extremity to the posterior end of the oesophagus is about 3–4 mm. in the male and 4.3–5.5 mm. in the female. The distance from the same point to the junction of the anterior and posterior divisions of the oesophagus is about 0.6–0.7 mm. in both sexes. The nerve-ring is situated a little behind this

point. The positions of the cervical papillæ and excretory pore have not been determined.

The pharynx has a very characteristic form, consisting of a relatively wide anterior chamber (fig. 1, *ph.*¹) measuring 0.045–0.055 mm. in length and 0.03–0.032 mm. in outside diameter, and a long tubular posterior portion (fig. 1, *ph.*²) of narrower calibre. The latter measures 0.14–0.2 mm. in length and about 0.01–0.018 mm. in outside diameter. The lumen of the posterior tube is very sharply marked off from that of the anterior chamber, and is only about half as wide. The chitinous wall of the pharynx, in both portions, exhibits irregular transverse markings. The anterior chamber contains, as usual, a ring of forwardly-pointing teeth near its opening. These teeth appear to be eight in number (two subdorsal, two subventral, and four sublateral). The walls of the pharynx are slightly expanded in front of the point of origin of the teeth.

The caudal end of the male (fig. 2) is provided with numerous prominent papillæ. There are six pairs of postanal papillæ, of which five are subventral and one (the second from the cloacal aperture) rather more laterally placed. The preanal papillæ consist of a subventral series of seventeen or eighteen on each side, and a second row on each side containing three or four papillæ, situated more laterally and at a little distance from the cloaca. The spicules are unequal and dissimilar, the left being 0.25–0.26 mm. long and ending in three short prongs with slight membranous expansions, while the right spicule is only 0.12–0.14 mm. long and is broad and flattened, resembling an accessory piece.

The vulva of the female is situated slightly behind the middle of the body, at 13–16 mm. from the posterior end. The vagina is short and muscular, turns posteriorly from the vulva, and gives off two directly opposed uterine branches. The eggs are oblong-oval, with very thick shells measuring 0.045–0.047 mm. \times 0.025–0.027 mm.

This makes the seventh species to be definitely referred to the genus *Rhabdochona*. A comparative table of the six species previously known has been given by Spaul (1927).

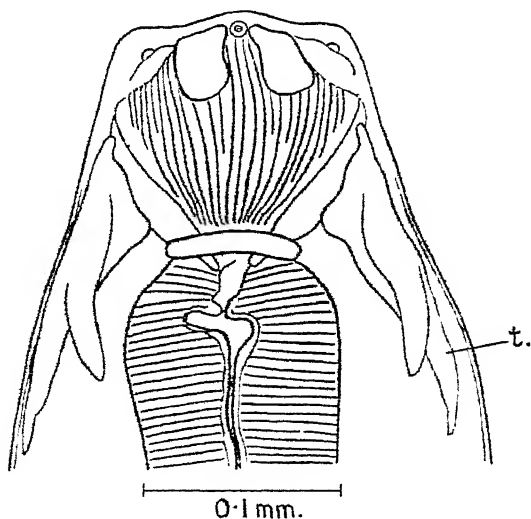
Family Camallanidæ.

Camallanus kirandensis, sp. n. (Figs. 3 & 4.)

This species is represented by one male and two females obtained from the gut of a "Tanganyika barbel" (? *Barbus* sp.) at Kirando.

The male measures 9 mm., the females about 20 mm. in length. The maximum thickness is 0.48 mm. in the male and 0.9 mm. in the female. The cuticular striations, in the middle region of the body, are at intervals of about 15μ in the male and 35μ in the female. The dorso-ventral diameter of the head, at the anterior angles, is about 0.1–0.13 mm. The distance from the anterior extremity to the posterior end of the œsophagus is 1.82 mm. in the male and 2.4 mm. in the female; from the same point to the end of the muscular portion of the œsophagus 0.82 mm. in the male,

Fig. 3.

*Camallanus kirandensis*, sp. n.

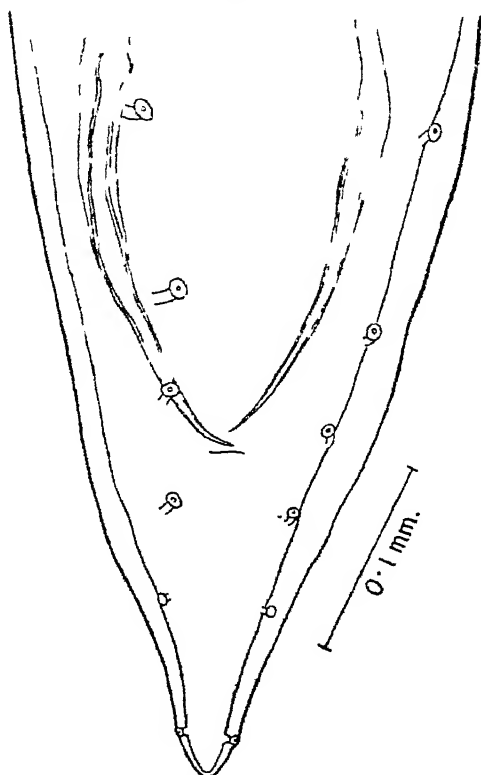
Anterior end of female, lateral view. *t.*, "trident."

1 mm. in the female. The nerve-ring is situated a little in front of the middle of the muscular œsophagus, with the cervical papillæ just in front of it. The chitinous buccal valves have the following dimensions:—Length (including the posterior ring) in male 0.11 mm., in female 0.13–0.14 mm. Width in male 0.1 mm., in female 0.12–0.13 mm. There are from twenty-two to twenty-six longitudinal ridges on each valve, and each valve has a pair of oblong thickenings on its outer surface anteriorly, of a darker brown colour than the rest of the valve. The "tridents" are well

developed, the length of the middle prong being about 0.11–0.14 mm.

The tail of the male is 0.16 mm. long. There are ten pairs of caudal papillae, of which three are postanal and seven preanal. The caudal alae are only slightly developed. The

Fig. 4.



Camallanus kirandensis, sp. n.

Posterior end of male, ventral view.

right spicule is considerably longer and stouter than the left, their lengths being 0.22 mm. and 0.18 mm. respectively.

The tail of the female is about 1.4 mm. long. The position of the vulva has not been made out. The blind posterior branch of the uterus extends beyond the anus to the extreme posterior end of the body-cavity.

Order DIOCTOPHYMOIDEA.

Family Diectophymidæ.

Eustrongylides sp.

Larval forms of species of this genus were found encapsuled on the outside of the stomach of (a) the "Singa" (*Dinotopterus cunningtoni*) and (b) a Cichlid (? *Tilapia nilotica*), at Kiundo.

ACANTHOCEPHALA.

Family Neoechinorhynchidæ.

Polyacanthorhynchus sp.

A single immature female specimen, obtained from the liver of an undetermined fish at Kigoma, appears to belong to this genus. Apart from its small size, it closely resembles *P. macrorhynchus* (Diesing), from the South American fish *Arapaima gigas* (see Baylis, 1927). It measures about 8.3 mm. in length, including the incompletely evaginated proboscis and neck, which together measure about 1.4 mm. The anterior half of the body is stout, having a maximum diameter (under cover-glass pressure) of 1.1 mm., while the posterior portion is much more slender. There are nine transverse rows of spines on the anterior portion of the body, or base of the "neck." The proboscis, in the partly evaginated condition, is club-shaped, being considerably thicker in front than behind. It bears about twenty-four longitudinal rows of hooks. Of the hooks visible externally, the most anterior are relatively stout and measure, from the curve to the point, about 0.07 mm. Posteriorly the hooks become much more slender, and those a little behind the middle of the proboscis are longer (about 0.09 mm.). From this point backwards they gradually decrease in length, the most posterior being very small (about 0.02 mm.).

GESTODA.

Order BOTHRIOCEPHALIDEA.

Family Caryophyllæidæ.

Caryophyllæus laticeps (Pallas, 1781).

Several specimens were obtained from the intestine of *Barbus tropidolepis* at Kirando. They show no differences of any importance from European specimens.

Monobothrioides cunningtoni, Fuhrmann & Baer, 1925.

A number of examples of this species were collected from a "mud-feeding fish" (presumably a Siluroid) at Kirando. These specimens attain a somewhat larger size than the types in Dr. Cunningham's original collection (now in the British Museum (Natural History)). The largest (when mounted in balsam) has a length of about 48 mm., with a maximum width, across the scolex, of 2 mm., and of 1.5 mm. across the body.

Lytocestoides tanganyikæ, gen. et sp. n. (Figs. 5 & 6.)

Host. A fish (probably *Alestes* sp.).

Position. Intestine.

Locality. Kirando.

Of this interesting form the material is in very indifferent condition, owing, apparently, to maceration. It is therefore impossible to give a complete account of its anatomy. Sufficient details can, however, be made out to show that it possesses a combination of characters at present unknown in the family, and this seems to necessitate the erection of a new genus.

The specimens are of various sizes, ranging from immature forms about 3 mm. in length and 0.95 mm. in width to a maximum length of about 11 mm. and a width of 3 mm. A specimen about 6.5 mm. long (when mounted in balsam) already contains eggs in the uterus.

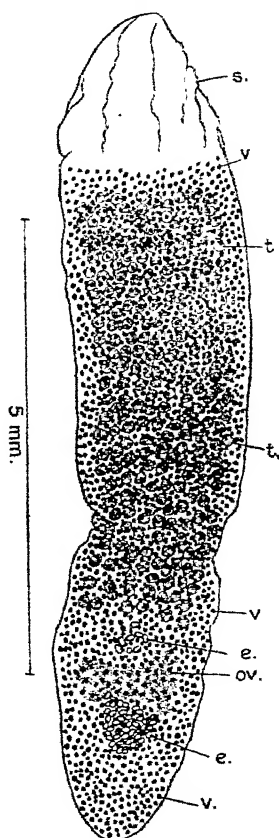
The general form of the body is slightly flattened, especially in the anterior half. The anterior end is usually rather more pointed than the posterior. The anterior region, or scolex (fig. 5, *s.*), is not wider than the rest of the body. It is roughly conical, though variable in shape according to state of contraction, and its surface is usually thrown into a few irregular longitudinal folds or wrinkles. This scolex is the only portion of the body which is free from organs belonging to the genital system. It extends to a distance of 1.1–1.8 mm. from the anterior extremity in mature specimens (in balsam). Owing to the condition of the material it is unfortunately impossible to make out any musculature or nervous system.

From the posterior limit of the scolex to the extreme posterior end of the body the rounded vitelline follicles (figs. 5 & 6, *v.*) extend in an almost uninterrupted layer just below the surface, completely surrounding all the other internal organs. They are arranged for the most part in a single layer, and

the only region free from them is a small area surrounding the genital pore on the ventral surface.

The genital pore is situated at about the posterior quarter of the body, and apparently leads into a large atrium into

Fig. 5.



Lytocestoides tanganyikæ, gen. et sp. n.

Entire animal, from a whole preparation. *e.*, eggs in uterus; *ov.*, ovary; *s.*, scolex; *t.*, *t.*, testes; *v.*, *v.*, vitelline follicles (the black dots representing these are relatively too small).

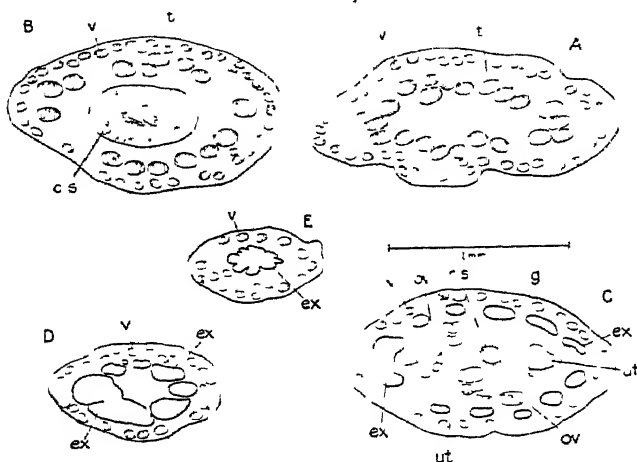
which open the cirrus-sac anteriorly and the uterus posteriorly.

The testes (figs. 5 & 6, *t.*) are larger than the vitelline follicles, having a diameter of about 0.15–0.18 mm. They

extend forward from just in front of the genital pore nearly as far as the anterior limit of the vitellaria, forming a second sheath within these, for the most part one testis deep. They do not invade the central portion of the parenchyme, which is partly occupied by the vas deferens and the large cirrus-sac.

The ovary (figs. 5 & 6, *ov.*) is of vaguely defined shape in the material available, but appears to consist of a number of follicles, and lies close behind the genital pore. The uterus

Fig. 6.



Lytocestoides tanganyikæ, gen. et sp. n.

Transverse sections through different regions of the body:—A, anterior part of testicular region; B, posterior part of testicular region; C, ovarian and uterine region; D, E, post-uterine region, showing coalescence of excretory canals.

c.s., cirrus-sac; *ex.*, excretory canals; *g.*, uterine glands; *ov.*, ovarian follicles; *r.s.*, receptaculum seminis; *t.*, testes; *ut.*, uterus; *v.*, vitelline follicles.

is relatively very short and contains few eggs. It extends at first posteriorly from the ovary, and its coils are, in this region, surrounded by a large number of glandular cells. It then turns anteriorly and extends to about an equal distance in front of the ovary. The course of the vagina has not been made out, but what appears to be a receptaculum seminis at its posterior end has been seen in transverse sections (fig. 6, C, *r.s.*). The eggs are relatively large and roundish-oval in

shape, measuring, when ready for laying, about 0.11 mm. \times 0.08 mm.

In the posterior region, in transverse sections, several (usually eleven) wide longitudinal excretory canals can be seen (fig. 6, C, *ex.*), lying below the layer of vitelline follicles. These vessels can be traced forward as far as the level of the genital pore, and coalesce near the posterior end of the body to form a system of large sinuses (fig. 6, D, *ex.*), eventually communicating with a single wide duct (fig. 6, E, *ex.*) which opens by a small pore at the extremity.

Systematic Position.

The affinities of this species are difficult to determine, on account of the impossibility of making out, in the material available, the arrangement of the musculature. Great advances have been made recently in the classification of this group, thanks to the work of Nybelin (1922), Fuhrmann & Baer (1925), Woodland (1923, 1926), and Hunter (1927). As a result, it is important to know the disposition of the muscular layers and their relation to other structures, in order to decide the systematic position of a given species. In the recent revision of the Caryophyllæidæ by Hunter (1927) the new subfamily Lytocestinæ is separated from the Caryophyllæinæ solely by the position of the inner layer of longitudinal muscles. In the Lytocestinæ these are internal to the vitellaria, which are therefore considered to be "cortical," whereas in the Caryophyllæinæ the vitellaria are internal to the muscles, and therefore "medullary."

In the form under discussion it seems doubtful whether the very superficial position of the vitellaria would permit of their being called "medullary" (or, in other words, whether there can have been two layers of longitudinal muscles external to them). It seems, therefore, probable that the species is more closely related to the Lytocestinæ than to the Caryophyllæinæ of Hunter.

The subfamily Lytocestinæ contains the genera *Lytocestus*, Cohn, 1908, *Monobothrioides*, Fuhrmann & Baer, 1925, and *Capingens*, Hunter, 1927. In the two former genera, as at present defined, post-ovarian vitellaria are absent. The present form, therefore, stands in marked contrast to them in this respect. It is apparently more like *Capingens*, in which there is a post-ovarian group of vitellaria, joined to the main anterior mass by lateral rows of follicles in the ovarian region. *Capingens*, however, has a scolex with a pair of well-defined

bothria, and the numerous excretory canals are external to the vitellaria.

It seems, therefore, probable that the present species represents a new genus, which may be defined as follows:—

LYTOCESTOIDES, gen. nov.

Lytocestinæ (?) with a short conical scolex, not broader than the rest of the body, and without bothria. Vitellaria superficial, forming a continuous layer (except for a small ventral area in the immediate neighbourhood of the genital pore), which surrounds the testes and other organs and extends behind the ovary to the posterior end of the body. Testes also arranged in a layer, internally to the vitellaria and surrounding the central portion of the parenchyme. Genital pore at about the posterior quarter of the body. Cirrus apparently opens into a common atrium with the uterus. Uterus relatively short. Excretory canals, at least in posterior region of body, internal to vitellaria.

Genotype. *L. tanganyikæ*, sp. n., parasitic in the intestine of a fish.

Order TÆNIIDEA.

Family Proteocephalidæ.

Proteocephalus dinotopteri, Fuhrmann & Baer, 1925.

A few specimens of this species were obtained from the type-host, the "Singa" (*Dinotopterus cunningtoni*), at Kirando.

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LXVIII.—On some new Australian Mites of the Families Trombidiidæ and Erythreidæ. By STANLEY HIRST.

(Zoological Department, Medical School, University of Adelaide, South Australia.)

Family Trombidiidæ.

Chyzeria australiense, sp. n.

Size moderate, the body being narrow and fairly elongated. This species, in fact, is smaller and narrower than *C. novæzealandiæ*, Hirst, from which it also differs in having the lateral processes of the body much reduced in size. Cephalothoracic area distinct, being at a much lower level than the abdominal part. Anteriorly the former has a little median knob-like process as in *C. novæzealandiæ*. Crista also very similar, consisting of a little double knob-like structure bearing the pair of fine pseudostigmal hairs; this knob is continued posteriorly by a patch of chitinated integument as in *Dinothrombium*. Eyes paired and situated on a slight tubercle without pedicel. Abdominal portion of body furnished anteriorly on its dorsal surface with two long slender processes, one being placed on each side. Lateral processes quite small, being obsolete. At the posterior end of the body there are two better-developed lateral processes on each side. There is also a posterior median process ventral in position and more slender than the others. Setæ or dorsum mostly plain, stiff, rather long, and spini-form; those on the processes arise from very prominent bases, giving the former a rough appearance. There are also some slender plumose hairs, which are usually curved; these are chiefly present laterally and on the processes. Central area of dorsum strongly chitinated and punctate; very fine plain hairs arise from the punctations. Terminal claw of penultimate segment of palp long and strong; there is also a distinct comb on the inner side, the distal tooth of which is fairly thick. Palpal tarsus of moderate length and width. Tarsus of first leg more than three times as long as its own height and longer than the metatarsus.

Measurements. Length of body 1.89 mm., its width about .75 mm.; length of metatarsus of first leg .37 mm.; length of tarsus of same .52 mm.; height of tarsus .15 mm.

Habitat. Swan River, West Australia. In nest of *Ponera lutea*. South Australian Museum Coll.

Neotrombidium barringtonense, sp. n.

An elongated form resembling *Neotrombicula* in general appearance. Size small. Transverse post-thoracic groove present. Both sensillar areas of the crista are distinct, the anterior one is in the form of a little almost truncate projection bearing the anterior

pair of fine *pseudostigmal hairs*. There is a large anterior and a small posterior *eye* on each side. *Hairs* on *dorsum* numerous, minute and curiously modified, being composed of three subequal branches which curve against one another so that they look almost like flattened scales. *Penultimate segment* of *palp* with the usual terminal claw, and dorsal to it there is a spiniform seta and also a few thinner setæ. *Palpal tarsus* slender, fairly elongated, and rather irregular in outline. *Tarsus* of *first leg* longer than in the two species of the genus hitherto known to science, being a little less than four times as long as high and distinctly longer than the preceding segment (*metatarsus*).

Measurements. Length of body 1.52 mm., its width .75 mm.; length of metatarsus of first leg .17 mm.; length of tarsus of same .21 mm.; height of tarsus .06 mm.

Habitat. Barrington, New South Wales, on the Queensland border, a single specimen found by the author under the bark of a living Eucalypt, June 1927.

NOTE.—The occurrence of the genus *Neotrombidium* in Australia is of some interest, for the only other two species known are both South American.

Diplothrombium australiense, sp. n.

Colour red. *Size* very small. *Body* almost as wide as long. In the middle of the *crista* there is a single *sensillary* area, but it is composed of three pairs of *pseudostigmal hairs*. A fairly long, finely pointed *nasal process* is present on the anterior margin of the *cephalothorax*. A little to the side of the sensillar area there is a pair of *eyes* on a tubercle, the pedicel of which is obsolete. *Body-hairs* very short, smooth, stiff, and often curved; each springs from the anterior margin of a minute oval marking. *Penultimate segment* of *palp* with a stout little ventral thorn, as well as the usual terminal claw. *Tarsus* of *palp* with a terminal spiniform seta, and there are two shorter but similar setæ near the tip. *Metatarsus* of *first leg* much shorter than tarsus and not enlarged; *tarsus* of this leg considerably swollen, the height, however, is less than the length. *Tarsi* of all the legs with a groove dorsally at the apical end.

Measurements. Length of body .91 mm., its width .75 mm.; length of metatarsus of first leg .10 mm.; length of tarsus of same .165 mm.; height of tarsus .11 mm.

Habitat. Charleville, Queensland, June 1927. A few specimens collected by the author on the banks of the Warrego. Also specimens from Dubbo found under pieces of damp Eucalyptus bark by the side of the river. Also Gawler, South Australia, specimens found under damp stones near the stream, March 1927.

Microtrombidium barringtonense, sp. n.

Size small. *Body* moderately elongated, being enlarged somewhat anteriorly and shouldered. *Post-thoracic groove* distinct.

Eyes absent. *Sensillar area* of the *crista* posterior in position, being continued forwards by the usual fine chitinous linear structure. No *nasal process*. *Dorsum* densely furnished with short, fine, plumose *hairs*, the secondary hairlets of which are quite short except a few near the distal end; these hairs are not enlarged at the tip, however, being cylindrical throughout their length. *Chelicera* of the normal Trombidiid type, being in the form of a slender hook. *Penultimate segment of palp* with the usual terminal claw well developed; on the inner side there are two or three minute but distinct spines; *palpal tarsus* rather slender and elongated. *Legs* slender. *Tarsus* of first leg longer than the preceding segment (*metatarsus*), and it is four times as long as its own height, being distinctly narrowed towards its distal end.

Measurements. Length of body about 1.15 mm.; length of metatarsus of first leg .25 mm.; length of tarsus of same .34 mm.; height of tarsus .08 mm.

Habitat. Barrington, New South Wales, 13. v. 1927; a single example found by the author under a log on the plain.

NOTE.—This species is rather intermediate between *Trombicula* and *Microtrombidium*, and lacks the eyes usually present in the latter genus.

Microtrombidium (Enemothrombium) collinum, sp. n.

Colour red. *Size* small. *Body* much longer than wide, being moderately elongated. A pair of *eyes* on each side, not borne on peduncles. *Body-setæ* all short, septate, and chiefly of two distinct kinds, viz., some setæ have the distal end bulbous or rather shaped like the head of a thistle, being considerably swollen; other setæ are not or only slightly enlarged distally, the latter are quite short, being cylindrical, of moderate thickness, and covered all over with tiny prickles. *Penultimate segment of palp* with a double inner comb of fine setæ, but it is rather irregular; the external surface of this segment has the usual two spiniform setæ. *Palpal tarsus* long. *Tarsus* of first leg elongated, being a little over three times as long as its own height, and considerably longer than the preceding segment (*metatarsus*). Posterior tarsi short, and they have a deep excavation dorsally just before the end of the limb. Some of the hairs on the dorsal surface of the legs are club-shaped.

Measurements. Length of body 1.31 mm., its width .85 mm.; length of metatarsus of first leg .20 mm.; length of tarsus of same .29 mm.; height of tarsus .09 mm.

Habitat. Tununda, South Australia. A single specimen found by the author under a damp stone close to stream, 23. iii. 1927.

Microtrombidium (Enemothrombium) wyandræ, sp. n.

Colour bright red. *Size* rather large. *Body* much longer than wide. A pair of *eyes* on each side, the peduncle being obsolete.

No *nasal process*. *Sensillar area* of *crista* posterior in position. Extreme *anterior margin* of *cephalothorax* with numerous very fine, plumose, forwardly directed hairs. *Setæ* of *dorsum* numerous, short, and of two distinct kinds, viz., setæ with large swollen distal ends shaped like thistles and crowned with a whorl; also more numerous setæ which have the distal end much smaller but still enlarged, being in the form of an irregular tubercle studded with rather elongated granules. Besides the well-developed terminal thorn, the *penultimate segment* of the *palp* has a second large inner thorn, but it is much shorter than the terminal one; there is also a distinct double comb of fine setæ internally, the distal setæ of which are fairly thick. On its external side this segment has two distinct spiniform setæ. *Palpal tarsus* of moderate length, fairly stout and slightly club-shaped; proximal segments of *palp* dorsally with club-shaped hairs. *Tarsus* of *first leg* considerably longer than the *penultimate segment*, the tarsus itself being a little less than five times as long as its own height. Many of the hairs on the legs are brush-shaped; there is also a narrow dorsal line or band of very short, thin, simple hairs on the legs.

Measurements. Length of body 2·7 mm., its width about 1·5 mm.; length of metatarsus of first leg ·37 mm.; length of tarsus of same ·53 mm.; height of tarsus ·11 mm.

Habitat. Wyandra, Queensland, July 27. A single specimen found by the author under a log of wood.

Dinothrombium nynganense, sp. n.

Colour red. *Size* rather small. *Body* widest anteriorly and apparently with a slight post-thoracic furrow; posterior notch not present. *Crista* normal for the genus. *Ocular tubercle* rather stout. *Hairs* on *dorsum* fairly elongated, slender, of even thickness throughout their length; they are densely furnished with accessory hairlets, but the latter are not very long. *Palpal tarsus* of moderate length and stoutness, being club-shaped. *First leg* distinctly longer than the others. *Tarsus* of first leg about three times (or a little less) as long as its own height, being considerably longer than the *metatarsus*.

Measurements. Length of body 1·4–1·8 mm., its width about 1·25 mm.; length of metatarsus of first leg ·26 mm.; length of tarsus of same ·35 mm., its height ·12 mm.

Habitat. Nyngan, New South Wales, August 1927. Numerous specimens found by the author under stones and fragments of wood along the margin of water-hole.

Dinothrombium splendidum, sp. n.

Size very large. *Body* with a distinct notch posteriorly as in *Sericothrombium*. *Paired eyes* situated on a peduncle. *Hairs* on *dorsum* very numerous, usually somewhat curved, rather slender and quite short; they are sometimes practically the same width throughout their length, but more often the apical third is very

slightly enlarged; these hairs are plumose, the secondary hairlets with which they are clothed being very short and fine. The *penultimate segment* of the *palp* is only furnished with a *terminal claw*. *Palpal tarsus* fairly long and club-shaped. *Claws of legs* slender, those of the first tarsus minute. No *pulvilli*. *Tarsus of first leg* more than four times as long as high and much longer than the *metatarsus*.

Measurements. Length of large ovigerous female 5.4 mm., its width about 4.2 mm.; length of metatarsus of first leg .72 mm.; length of tarsus of same .98 mm.; height of tarsus .22 mm.

Habitat. Murray River, South Australia. Several specimens in the South Australian Museum Coll. There is also a rather small damaged specimen, possibly a nymph of the same species from Mullewa, Western Australia (*H. F. May*).

Dinothrombium torridum, sp. n.

Colour red. *Size* large. Anterior third of *body* the widest; posterior notch present(?). *Hairs on dorsum* more elongated, finer, less rigid, and more feathery than in *D. splendidum*, the accessory hairlets with which they are furnished being very much longer but less numerous than in that species. *Palpal tarsus* very elongated; claw of *penultimate segment* of *palp* also very long. *Tarsus of first leg* about four times as long as its own height, being considerably longer than the *metatarsus*.

Measurements. Length of body 3.2 mm., its greatest width about 2.4 mm.; length of metatarsus of first leg .56 mm.; length of tarsus of same .70 mm.; height of tarsus .18 mm.

Habitat. Northern Territory (*S. A. White*). Four dry specimens, one of which has been mounted for examination. South Australian Museum Coll.

Dinothrombium crassum, sp. n.

Size very large. *Body* widest anteriorly and with a distinct notch posteriorly. *Ocular peduncle* rather more slender than in *D. splendidum*. *Hairs on dorsum* short, plumose, and not modified in any way; they are somewhat more elongated and usually straighter than is the case in *D. splendidum*; the accessory hairlets with which these hairs are clothed much less numerous and longer than in *D. splendidum*, being rather sparse; these hairlets are, however, much shorter than in *D. torridum*. *Palpal tarsus* much more elongated than that of *D. splendidum*. *Metatarsus* and *tarsus of first leg* practically equal in length, the tarsus not being so elongated as that of *D. splendidum*, but still is considerably more than three times as long as its own height.

Measurements. Length of body 4.3 mm., its greatest width 3.6 mm.; length of metatarsus of first leg .75 mm.; length of tarsus of same .73 mm.; height of tarsus .21 mm.

Habitat. Ooldea, South Australia (*A. O. Jones*). Three specimens in South Australian Museum Coll.

Allothrombium wyandrae, sp. n.

A large heavily-built mite. *Colour* red. *Body* widest anteriorly. *Ocular tubercle* stout and with a short but distinct peduncle. *Hairs* on *dorsum* mostly very short and densely plumose, the secondary hairlets with which they are furnished being of moderate length, often somewhat curved, and arranged somewhat after the fashion of those of *A. terræreginæ*, Hirst (see Ann. & Mag. Nat. Hist. (9) xviii. pl. xxiii. fig. 1). *Palpal tarsus* club-shaped, but one side of the distal end is heavier than the other. *Pulvillus* of *legs* distinct, but not very large. *Metatarsus* of *first leg* a little shorter than the *tarsus*, the latter moderately elongated, being more than twice its own height or width.

Measurements. Length of body about 4 mm., its width 2·7 mm.; length of metatarsus of first leg ·53 mm.; length of tarsus of same ·62 mm., its height ·26 mm.

Habitat. Wyandra, Queensland. A single example found by the author under a log of wood, July 1927.

Family Erythræidæ.

Cæculiosoma nasutum, sp. n.

Size rather small. *Colour* (dry specimen) dark, *dorsum* almost blackish variegated with minute brown specks, *crista* also brownish. *Legs* rather dark brown. The *dorsum* has the appearance of being rough or coarsely granular (due to the large scales). Anteriorly there are some deep notches or bays for the reception of the proximal segments of the anterior legs. Central part of *crista* linear, the very fine anterior pair of *pseudostigmatal hairs* arise from the usual little circular sockets and are situated at the base of a long slender median process jutting out from the anterior margin of the body; there are six or seven elongated but flattened leaf-like setæ on each side of this nasal process. *Posterior sensillar area* near the middle of the *dorsum*. There is a distinct socketed *eye* on each side of the linear part of the *crista*, some distance in front of the posterior sensillar region. *Dorsal setæ* scale-like or leaf-like, being almost fan-shaped; they are wide, flattened, and not very long, being faintly ribbed, the apex rather widely rounded off. *Palp* weak, the *tarsus* not appendiculate. *Penultimate segment* of *palp* much shorter than the *tarsus*, and it has a sharply pointed thorn apically, but this is small, thin, and inconspicuous. *Legs* rough and robust, being furnished with fan-shaped setæ. There is a little hollow on the dorsal surface of the *metatarsi* of the legs together with two little lobe-shaped projections. *Metatarsus* of first leg slightly longer than the *tarsus*, the latter not very long, being a little more than twice its own height.

Measurements. Length of body 1·70 mm., its width about 1·05 mm.; length of metatarsus of first leg ·35 mm.; length of tarsus of same ·31 mm.; height of tarsus ·13 mm.

Habitat. Cairns District, Queensland. A single specimen found by Mr. A. M. Lea under fallen leaves.

Leptus pilosus, sp. n.

Size not very large. Entire length of *crista* strengthened and obscured by a rather wide longitudinal band of strongly chitinated integument. *Nasal process* apparently absent. *Anterior sensillar area* in the form of a little bulbous projection jutting out in front and furnished with long stiff setæ, the feathering of which can only be seen under considerable magnification; a pair of very fine *pseudostigmal hairs* is also present on this little bulbous structure. *Posterior sensillar area* entirely surrounded by the chitinous band; the *posterior pseudostigmal hairs* are long and fine. A pair of *eyes* subequal in size is situated on a little chitinous plate contiguous laterally with the longitudinal chitinous band, a little in front of the posterior sensillar area. There are several hairs on this *ocular plate* as well as the eyes. *Hairs* on *dorsum* of moderate length, slender, and not flattened or modified in any way; these hairs at first sight seem to be plain, but when examined under a high power of the microscope are seen to be feathered. *Palpal tarsus* well developed, being club-shaped and swollen. *Fourth segment* from distal end of palp also swollen. *Legs* of fourth pair much longer than the others. First pair of legs slightly the thickest. *Fourth leg* much the longest. *Metatarsus* of first leg more than once and a half as long as the *tarsus*, the latter almost three times as long as high. *Tarsi* of legs with a slight scopula.

Measurements. Length of body 2.2 mm., its width 1.6 mm.; length of metatarsus of first leg .67 mm.; length of tarsus of same .42 mm.; height of tarsus .135 mm.

Habitat. Dubbo, New South Wales. Two specimens found by the author under stone and damp wood, 7. v. 1927.

Leptus reginæ, sp. n.

Colour (living specimens) greyish, almost black, variegated with minute pale greyish hairs scattered all over the dorsum, and usually there is a pale median stripe. Venter rather pale, sometimes with a reddish tinge. Legs buff-coloured. *Size* rather large. *Body* oval, being longer than wide. Anterior part of *cephalothoracic area* dorsally strongly chitinated. *Crista* normal, both *sensillar areas* being present, the anterior one is surrounded by fairly elongated setæ of moderate thickness and is situated at the base of a long *nasal process*. *Eyes* paired, sessile. *Setæ* on *dorsum* minute and scale-like, but rather narrow and pointed apically, being very like spear-heads; they are clothed with very minute secondary hairlets. *Palpal tarsus* club-shaped, but not swollen, being of moderate thickness only. First and fourth pairs of *legs* longer than the others, the latter being the longer. *Metatarsus* of first leg much longer than the *tarsus*, the latter is about three times as long as its own height.

Measurements. Length of body 3.2 mm., its width about 2.3 mm.; length of metatarsus of first leg .90 mm.; length of tarsus of same .60 mm.; height of tarsus .17 mm.

Habitat. Adelaide, South Australia. Very abundant under bark of *Eucalyptus* trees in the park-lands which encircle the city, December 1927.

Leptus antepodianus, sp. n.

Size large. Anterior part of *cephalothoracic portion* of body bearing the *paired eyes* and *crista* strongly chitinized. Both *sensillar areas* of *crista* are present, the *anterior* being in the form of a little bulbous tubercle furnished with stiff, rod-like, plumose setæ of moderate length; *nasal process* long and slender, and apparently at a lower level than the anterior sensillar area. *Body-setæ* on *dorsum* dark, and they are not shaped like those of *L. reginæ*, having the distal part narrower, more drawn out, and sharply pointed. *Terminal claw* of *penultimate segment* of *palp* poorly developed, being weaker than that of *L. reginæ*. *Palpal tarsus* club-shaped and swollen, being much stouter than that of *L. reginæ*. *Legs* fairly long. *Metatarsus* of *first leg* a little less than twice the length of the *tarsus*, the latter moderately elongated, being a little more than three times as long as its own height.

Measurements. Length of body 2.9 mm., its width about 2.1 mm.; length of *metatarsus* of *first leg* 1.09 mm.; length of *tarsus* of same .60 mm.; height of *tarsus* .18 mm.

Habitat. Tununda, South Australia. A single specimen found by the author under a piece of limestone on a hillside, 24. iii. 1927.

Leptus imperator, sp. n.

Size large. *Eyes* paired and sessile. *Crista* linear; both *sensillar areas* are present, the anterior one being prolonged to form a long *nasal process* bearing a number of long slender setæ, including two pairs near its apex. *Setæ* on *dorsum* not very long, being stiff and spiniform, the feathering absent or indistinct. *Terminal claw* of *palp* rather small and curved. *Palpal tarsus* very short and stout. First and fourth pairs of *legs* very long, the two segments preceding the *tarsus* being elongated. *Tarsi* of *legs* rather short and high, and furnished with thick ventral scopulas. *Metatarsus* of *first leg* about twice as long as the *tarsus*, the latter rather high but considerably more than twice as long as its own height.

Measurements. Length of body about 2.3 mm., its width 7 mm.; length of *metatarsus* of *first leg* about 1.35 mm.; length of *tarsus* of same .68 mm.; height of *tarsus* .27 mm.

Habitat. Lucindale, South Australia. No. 935, South Australian Museum Coll.

Microsmaris goannæ, sp. n.

Size small. *Body* moderately elongated and not very wide. *Post-thoracic groove* distinct both above and below. Only one

sessile *eye* on each side. *Crista* indistinct, being obsolete, but both pairs of sensory hairs (pseudostigmata) can be distinguished, the anterior pair very short and with a group of about six longer hairs in front of them. The curious paired *eye-like structures* present on the dorsum in *M. mirandus*, Hirst, are also present in *M. goannæ*, but the flattened hairs on the circular rim apparently are longer and more slender in *M. goannæ* than is the case in *M. mirandus*. *Body-hairs* fine and simple, being devoid of accessory hairlets; most of them are exceedingly short, but scattered amongst them there are some much longer plain hairs. *Penultimate segment* of *palp* ending in a little claw. *Palpal tarsus* short, fairly stout, and slightly curved. *Metatarsus* of *first leg* much longer than the *tarsus*, the latter is fairly high, but still is more than twice as long as its own height.

Measurements. Length of body 1·43 mm., its width 1 mm.; length of metatarsus of first leg ·30 mm.; length of tarsus of same ·17 mm.; height of tarsus ·08 mm.

Habitat. Under bark of Eucalypt in garden, Fullarton, Adelaide, 27. xi. 1927. Several specimens collected by the author and Miss Joan Cleland.

Belaustium warregense, sp. n.

Body fairly elongated and widest anteriorly. Post-thoracic groove usually distinct. A single well-developed round sessile *eye* on each side. *Crista* rather long and slender, both sensillar areas being distinct, the anterior one long-oval in shape, and besides the pair of slender pseudostigmal hairs it has 5-7 comparatively long and stout plumose setæ. *Surface of body* lacking the ornamentation present in *Smaris*. *Setæ* on *dorsum* mostly slender and not very long, being often subcylindrical but sometimes shaped like the tail of a fox; they are clothed with numerous quite short, fine, accessory hairlets, which seem to have a tendency to be arranged in longitudinal series; there are some patches and bands of similar but stouter setæ and some rather thick brush-shaped hairs on each side of the posterior end of the *crista*. *Chelicerae* internal, being styliform. *Penultimate segment* of *palp* with the usual terminal thorn. *Palpal tarsus* not very wide and of moderate length. *Legs* of moderate length. *Tarsus* of *first leg* rather narrowed at both ends, being widest in the middle; it is a little less than three times its own height and slightly longer than the *metatarsus*.

Measurements. Length of body 1·7 mm., its width about 1·15 mm.; length of metatarsus of first leg ·26 mm.; length of tarsus of same ·33 mm.; height of tarsus ·115 mm.

Habitat. Cunnamulla, Queensland. Under bark of living Eucalypt on bank of water-hole of the Warrego River, 2. viii. 1927. Numerous specimens collected by the author.

LXIX.—*A remarkable new Himalayan Moth of the
Family Ecophoridæ.* By HERBERT STRINGER.

(Published by permission of the Trustees of the British Museum.)

TINEINA.

Ecophoridæ.

Lactistica pentoni, sp. n.

♂.—*Antennæ* whitish, cilia dark fuscous. *Palpi* whitish, mixed with dark fuscous, terminal segment white. *Head* and *thorax* (both much denuded in case of type) ochreous, with a mixture of white hair-scales. *Fore wing* elongate, narrow, costa almost straight, apex almost acute, termen oblique; fusco-rufous, with some white markings; a sub-marginal series of white interneural marks round posterior third of costa and termen, followed by a white line along dorsum; a slightly curved white line, hardly traceable through stigmata, from middle of base to dorsum, terminating in a white patch before tornus; arising from commencement of this line is another short white streak lying on the cell and disappearing before reaching costa; an irregular oblique white dash at posterior edge of cell; stigmata raised, plical beneath first discal, moderate, second discal moderate, oblong; veins posteriorly tinged with light reddish; cilia fusco-rufous mixed with black. *Hind wing* pale brown; a sub-marginal series of white marks round posterior part of costa and termen; cilia white, with a dark fuscous subbasal line. *Abdomen* reddish brown, annulate with whitish hair-scales. *Legs* reddish brown mixed with white; posterior tibiæ with expansible tuft above at apex, brownish tipped with black; posterior tarsi greatly elongate, half as long again as tibiæ, with tufts of brownish scales above, tipped with black.

Exp. al. 50 mm.

Type in British Museum (Walsingham Coll.).

Hab. INDIA, Almora (Himalayas), Ranikhet, 2000 ft., 1913–14 (*Colonel R. H. Penton*).

I place this species provisionally in *Lactistica*, Meyr.*, with which it agrees in most features, except that in the hind wing vein 5 is curved and approximated to 4 at base,

* Journ. Bomb. Nat. Hist. Soc. vol. xvii. p. 741 (1907).

as in *Atopophrictis*, Meyr., whereas in *Lactistica* 5 and 6 are parallel; the new species further differs from *L. geranodes*, Meyr., in the white markings on the fore wing and the larger tufts on the tibiæ and tarsi.

Colonel R. H. Penton, who presented the specimen described above to the British Museum in exchange for a drawing of it, afterwards found in his collection a second example, about which he wrote to the late Mr. J. H. Durrant as follows:—

“The other specimen I have is, I think, still better, and you shall have it too in due course. I believe it is the same as the other. I caught them both at Ranikhet, Upper India; the year was either the summer of 1913 or spring of 1914. Ranikhet is a hill-station for troops, 8000 ft. high. I caught these two moths flying in the garden close to my verandah. I remember quite clearly being much impressed by their peculiar flight, as I had never seen anything like it amongst insects. The legs were outstretched, and they flew with an undulatory movement somewhat like that of a Whydah-bird, with its long tail.”

Colonel Penton was anxious that a description of this curious moth should be published by Mr. Durrant, whose untimely death, however, prevented the fulfilment of the donor's wish.

BIBLIOGRAPHICAL NOTICE.

Brachiopod Morphology and Genera (Recent and Tertiary). By J. ALLAN THOMSON. Pp. vi, 338; 2 pls. Ex. cr. 8vo. (New Zealand Board of Science and Art, Manual No. 7. Wellington, N.Z.: Government Printer. London: High Commissioner for New Zealand. 1927.) Price 17s.

THE publication of this work supplies a much-needed want to students of the Brachiopoda. Since the time of Davidson's famous ‘Monograph’ (1886–1888) considerable advances have been made in the detailed study of the recent species as well as of those of the Tertiary and earlier rocks. A comprehensive study of the researches of the many eminent workers, especially of the Recent and Tertiary forms, is very welcome, and its production could not have been in more capable hands than those of Dr. J. Allan Thomson, the Director of the Dominion Museum, Wellington, New Zealand.

Dr. Thomson has devoted a considerable number of years to the

* Meyrick, *Exot. Microlep.* vol. ii. p. 369 (1920).

close study of Brachiopod morphology, and the access he has had to the numerous southern Tertiary forms has been of the greatest service to him in his revision of the various species and genera. The author makes generous references to the works of the many writers who have in the past contributed their share in the elucidation of the many problems connected with the phylogeny and morphology of the Brachiopoda.

The early part of the manual is devoted to Brachiopod Morphology, and the later part to the description of Brachiopod Genera (Recent and Tertiary). The work is well illustrated with figures of structural details taken from Dr. Thomson's own papers and from the works of many other noted authorities. There is a useful bibliography, which is divided into a main list and lists of the Tertiary species of different geographical areas. There is, in addition, an index to technical terms and one of systematic names.

Two new subclass names—Gastrocaulia and Pygocaulia—are introduced, these being approximately equivalent to the older Inarticulata and Articulata of Huxley. The reasons for this change are clearly stated, and Beecher's and Schuchert's views are fully discussed. The new arrangement carries with it some emendations of Beecher's orders Atremata and Neotremata, which form the Gastrocaulia, and the erection of a new order—Palæotremata (for Rustellacea and Kntorginacea),—which is placed in the Pygocaulia with the Protremata and Telotremata. In addition, one new superfamily (Paterinacea), two new subfamilies (Platidiinæ and Laqueinæ), and eight new genera (viz., *Hispanirhynchia*, *Abyssothyris*, *Japaniathyris*, *Jaffaia*, *Pictothyris*, *Neobouchardia*, *Pirothyris*, and *Malleia*) are created.

There are interesting chapters on development, external and internal morphology of the valves, and the composition and structure of the shells. Much new information is introduced here, and old and new theories are discussed in a lucid manner. The inclusion of figures after Friele, Beecher, Buckman, etc., is very commendable, and saves considerable time in hunting up the original papers, some of which are occasionally difficult of access.

In the second part of the manual Dr. Thomson gives some useful observations on the conception of the genus, and then proceeds to the description of the Recent and Tertiary genera. Most of the genotypes are illustrated, and references are given to the literature of these. Some of the species included under certain of the genera are undoubtedly out of place, and, in the opinion of the reviewer, certainly represent further new genera. The portion dealing with the Terebratulidæ brings out very clearly the great advances made in recent years in the classification of this family.

J. WILFRID JACKSON.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

November 16th, 1927.—Dr. F. A. Bather, M.A., F.R.S.,
President, in the Chair.

The following communication was read :—

‘The Belemnite-Marls of Charmouth, a Series in the Lias of the Dorset Coast.’ By William Dickson Lang, Sc.D., F.G.S.; Leonard Frank Spath, D.Sc., F.G.S.; Leslie Reginald Cox, M.A., F.G.S.; and Helen Marguerite Muir-Wood, M.Sc., F.G.S.

Pale marls, lying in the Lias above beds with *Echioceras* and below those with *Androgynoceras*, extend along the Dorset coast for about 4 miles. Forming the third, and highest, Lias precipice on Black Ven, they are soon truncated by the eastern slope of that cliff, but reappear eastwards to form the second precipice at the western end of Stonebarrow Cliff. They descend to the beach at Westhay Cliff, and form a gentle syncline, so that the lowest beds are carried beneath the tide opposite Westhay Water. They rise for a short distance on Ridge Cliff, but soon are thrown down and out of sight by the Ridge Fault. Thereafter only the highest beds of the Belemnite-Marls are seen—as a reef opposite St. Gabriel’s Mouth, at the cliff-foot between St. Gabriel’s Water and Golden Cap, on the foreshore beneath Golden Cap, and again at the cliff-foot between Golden Cap and Seatown.

The marls contain few beds in which ammonites are well preserved. Ammonite-remains, however, are to be found throughout, and although the preservation is often poor, yet the following sequence has been established :—

- (13) *Beudanticeras centaurus* and other spp. Beds 120 e, 121.
- (12) *Tripidoceras* aff. *actæon*, *T. calliplocoides*, and other spp., *Dagyceras* Beds 120 a–120 d.
- (11) *Acanthopleuroceras* aff. *vulcani*, *A. mangenesti*, and other spp.; *Tragophylloceras ibex*, *T. wechleri*, and other spp. Beds 118 d, 119.
- (10) *Tripidoceras* aff. *massenunum*, *T. ellipticum*, and other spp. Bed 118 c.
- (9) *Coloceras pettos* and other spp.; *Uptonia bronni*. Bed 118 b.
- (8) *Uptonia jamisoni*, *U. bronni*, and other spp. Beds 116–118 a.
- (7) *Uptonia regnardi*, *U. bronni*; *Platyleuroceras* cf. *brevispina*. Bed 115.
- (6) *Platyleuroceras* cf. *brevispina*, *P. birchoules*, *P. cf. confusum*; *Polymorphites cf. quadratus*. Beds 113–114.
- (5) *Platyleuroceras* cf. *natrix*, *P. cf. oblongum*; *Polymorphites lineatus*, *P. cf. trizialis*; *Metozymoticeras lynx*, *M. cf. flavum*. Beds 110 b, 111, 112.
- (4) *Tetraspidoceras* spp., or some very similar forms. Bed 110 a.
- (3) *Gemmellaroceras peregrinum*, *Phricodoceras taylori*. Beds 106–109.
- (2) *Phricodoceras taylori*, *Apoderoceras leckenbyi* and other spp.; Bed 105.
- (1) *Epideroceras eaheredatum*, *Deroceras* sp. Beds 103 b, 104.

During the discussion on Dr. Lang’s paper on the Black Marls, it was asked whether the belemnites, like the ammonites, showed limited ranges and a crowded sequence. Except at a few horizons,

belemnites are not common below the Belemnite-Marls; but they abound in the Marls, and, if the outstanding forms are carefully collected, they show, like the ammonites, limited ranges and a crowded sequence. Thus:—

- (9) *Hastites spadix-ari* and other spp.; *Passaloteuthis apicicurvata* and other spp. Beds 119 (top), 120, 121.
- (8) Four new species of *Angeloteuthis*; a new species of *Passaloteuthis*. Beds 118, 119.
- (7) Another new species of *Passaloteuthis*. Beds 115–118 a.
- (6) A third new species of *Passaloteuthis* and a new species of *Clastoteuthis*. Bed 112.
- (5) *Passaloteuthis elongata* and a second new species of *Clastoteuthis*. Bed 111.
- (4) A fourth and a fifth new species of *Passaloteuthis*, the second new species of *Clastoteuthis*; *Pseudohastites longissimus*. Bed 110 b.
- (3) The last-mentioned two new species of *Passaloteuthis*; *Pseudohastites longissimus*, *P. junceus*, *P. charmouthensis*, *P. sp. nov.* Bed 110 a.
- (2) A sixth new species of *Passaloteuthis*. Beds 106–108.
- (1) A second new species of *Pseudohastites*. Bed 104.

Of the comparatively few species of Gastropod Molluscs, most come from horizons 120 & 121. This group, therefore, is not suitable for showing zonal distribution. The same may be said of the Lamellibranchs, but certain common forms, such as *Inoceramus ventricosus* and *Pecten rollei* range throughout the Belemnite-Marls; while species like *Lima gigantea* and *Oxytoma inaequivalve*, which range nearly throughout the Lias below the Belemnite-Marls, are also found in these beds.

Brachiopoda are rare below Bed 111; but the genus *Cincta*, represented by several species, is common in the Middle Marls, and apparently confined to them. *Tropiorhynchia thalia* appears first in Bed 114, and ranges as high as Bed 120. It is characteristic of, and abundant in, Bed 118–119, and has proved useful in inland sections.

One small specimen from the lower darker marls, Bed 110, has some resemblance to *Acanthothyris*, but this genus has not been previously recorded from beds below the Aalenian.

Dr. L. F. SPATH, in the course of his remarks on the Ammonites, said that he now believed that his previous definition of these divisions as 'subzones' was misleading, and that they were of purely local value. For example, the temporary appearance of *Cœloceras pettos* in various deposits and at different levels was governed by accidents of distribution, and the range of this species in one place and another (or its 'hemera') covers about ten of these subdivisions. The small non-sequences in the shallow-water deposits of the Dorset Lias, due to the temporary raising and lowering of the submarine erosion-level, are not considered to signify much. The two (overlapping) zones of *Ammonites jamesoni* and *A. ibex*, quite sufficient for wider correlation, give a far truer picture of the time-sequence than a pretentious list of imaginary 'hemera'.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.
[TENTH SERIES.]

No. 5. MAY 1928.

LXX.—*New or little-known Tipulidæ (Diptera).*—XXXIX.
Australasian Species. By CHARLES P. ALEXANDER, Ph.D.,
F.E.S., Massachusetts Agricultural College, Amherst,
Massachusetts, U.S.A.

THE species discussed in the present instalment are almost entirely members of the tribe Limoniini that were collected in Tasmania and south-eastern Australia by Dr. A. L. Tonnoir. A few additional specimens were secured by Mr. G. H. Hardy, to whom the material has been returned for inclusion in the collection of the University of Queensland. The Tonnoir series has been returned to Dr. Tonnoir. I extend my deepest thanks to Messrs. Hardy and Tonnoir for the privilege of examining this valuable series of crane-flies.

The localities in New South Wales, Victoria, and Tasmania, where Dr. Tonnoir collected the present material, have been discussed in an earlier part of this series of papers (*Ann. & Mag. Nat. Hist.* (9) xix. pp. 18-19, 1927).

Limonia perpulchra, sp. n.

General coloration velvety-black; anterior vertex broad, silvery; mesonotal præscutum black with four pale reddish-brown stripes; femora yellow with a black subterminal ring; wings pinkish brown with a heavy dark brown

pattern; abdomen dark brown, the intermediate sternites conspicuously ringed caudally with yellow.

Male.—Length 5·5–5·7 mm.; wing 6·8–7 mm.

Female.—Length 5·2–5·4 mm.; wing 6·3–6·5 mm.

Rostrum and palpi black, the former short. Antennæ with the basal segment of scape black, the remainder of the organ brown; basal flagellar segments globular, the segments passing through oval to elongate; verticils of the basal segments short, on the more distal segments becoming long and conspicuous. Anterior vertex conspicuously silvery; posterior vertex velvety-black, the occipital region somewhat paler; vertex between the eyes very broad in both sexes.

Pronotum velvety-black, somewhat more reddish brown medially. Mesonotal præscutum velvety-black with four pale reddish-brown stripes, the intermediate pair separated by a narrow shiny black vitta; humeri and lateral margins broadly velvety-black; scutal lobes reddish brown, the mesal margin of each narrowly blackened, the median area of the scutum pale; scutellum brown, the caudal margin broadly more reddish brown; postnotum reddish brown, the cephalic portion more or less blackened, more extensively so on the pleurotergite. Pleura brown with a velvety-black longitudinal stripe; dorso-pleural membrane ochreous. Halteres yellow, the knobs extensively infuscated, the extreme tips a trifle paler. Legs with the coxæ yellow, the bases infuscated, most extensively on the fore coxæ, where only the tips are pale; trochanters testaceous-yellow; femora brown, more yellow at base, with a broad black subterminal ring, the extreme apex conspicuously light yellow; tibiæ brownish black, the extreme base narrowly yellowish; tarsi black. Wings pale pinkish brown with a heavy dark brown pattern; extreme wing-base yellowish; cell *C* infuscated except at outer end; conspicuous brown spots distributed as follows: Prearcular cells; origin and fork of *Rs*, the latter confluent with a conspicuous seam along the cord and with the stigma; spots in bases of cells *R* and *M* near one-third of the length of cell *R*; tip of *Sc* and the stigma; a broad seam at outer end of cell 1st *M*₂; brown washes near wing-apex and in cells *M*, *Cu*, and the Anal cells, in the latter instance following the veins; some specimens have narrow dusky washes in cells *R*₁ and outer end of *R*; veins brown, with extensive pale bullate areas. Venation: *Sc* long, *Sc*₁ extending to opposite one-half to nearly two-thirds the length of the long *Rs*, *Sc*₂ at its tip; *Rs* strongly arcuated to angulated at origin; *R*₂ transverse,

about two-thirds of the vein R_{1+2} beyond it, the latter portion curved strongly into costa; cell 1st M_2 widened distally, equal to or longer than vein M_{1+2} beyond it; *m-cu* before fork of *M*.

Abdominal tergites dark brown, including the hypopygium; sternites conspicuously ringed caudally with yellow, this most evident on segments 2 to 6, the amount becoming less and finally obsolete on the distal segments; in some specimens the caudal margin of tergites 2 and 3 is vaguely brightened. Male hypopygium in structure almost as in *Dicranomyia*; basistyles much larger than the small ventral dististyles; spines of the rostral prolongation long, curved gently basad.

Hab. Tasmania.

Holotype, ♂, Mt. Farrel, February 8, 1923 (*A. Tonnoir*).

Allotopotype, ♀.

Paratopotypes, ♂ ♀; *paratype*, ♂, Strahan, February 1924 (*G. H. Hardy*).

Dicranomyia subdorsalis, sp. n.

General coloration reddish ochreous, the præscutum with three confluent brownish-black stripes; pleura dark brown with a transverse pale stripe beneath the wing-root; abdomen dark brown, the subterminal segments yellow; male hypopygium with the dorsal dististyle only slightly curved; ninth tergite with a group of about ten setæ on either side of the median line.

Male.—Length about 6·8 mm.; wing 7·8 mm.

Female.—Length about 7 mm.; wing 7·9 mm.

Rostrum about one-half the remainder of head, obscure yellow; palpi brownish black. Antennæ with the basal segment obscure brownish yellow; remainder of antennæ black; flagellar segments oval. Head brownish grey, the anterior vertex pale yellow; vertex at narrowest point a little wider than the first scapal segment.

Pronotum obscure yellow, brownish black medially. Mesonotal præscutum reddish ochreous, the dorsum with three confluent brownish-black stripes, restricting the ground-colour to the humeral angles and broad lateral margins; scutal lobes extensively brownish black, the median area pale; scutellum brownish testaceous, margined posteriorly with darker brown; postnotum with the mediotergite dark brown. Pleura obscure ochreous, the anterior pleurites dark brown, the pleurotergite likewise extensively infuscated, the ground-colour appearing as a transverse area

beneath the wing-root. Halteres pale, the knobs and distal two-thirds of the stem infuscated. Legs with the fore coxæ dark brown, the middle coxæ less infuscated, the hind coxæ yellow; trochanters obscure brownish yellow; remainder of legs dark brown, the femoral bases a little paler. Wings with a brownish tinge, the stigma conspicuous, oval, darker brown; cord, outer end of cell 1st M_2 , and vein Cu_1 indistinctly seamed with brown; veins dark brown. Venation: Sc_1 ending opposite the origin of Rs , Sc_2 removed from its tip to a distance varying from two-thirds to longer than $m-cu$, the latter close to the fork of M ; R_2 transverse, from two to three times Sc_2 beyond it. In the types there are one or more adventitious cross-veins in cell Sc near outer end.

Abdomen dark brown, the eighth and ninth segments yellow; hypopygium dark. Male hypopygium with the basistyles relatively small, the mesal lobe large, provided with long setæ. Ventral dististyle large and fleshy, the rostral prolongation slender, curved; the two spines nearly equal, the innermost a trifle longer, nearly straight, placed at about one-third their length apart, the inner one at the base of the prolongation, the outer one about its own length from the tip of the same; a swollen lobe on face of dististyle near base of the rostrum, this provided with five or six large setæ. Dorsal dististyle only gently curved, the tip suddenly narrowed. Ninth tergite gently notched, each lobe with conspicuous setæ; a group of about ten setæ on either side of the median line. Ovipositor with the bases black, the valves black at base, passing into reddish-horn colour; tergal valves much shorter and smaller than the sternal valves, gently upcurved to the acute tips, the sternal valves long and straight.

Hab. Tasmania.

Holotype, ♂, Adventure Bay, December 30, 1922 (*A. Tonnoir*).

Allotopotype, ♀.

Dicranomyia subdorsalis differs from *D. dorsalis*, Skuse, in the details of structure of the male hypopygium.

Dicranomyia albistigma, sp. n.

General coloration black, grey pruinose; wings whitish, heavily clouded with brown, the stigma white; $m-cu$ close to the fork of M ; male hypopygium with the ninth tergite deeply notched medially.

Male.—Length 8·85 mm.; wing 9–10 mm.

Female.—Length 8·92 mm.; wing 8·8–10·3 mm.

Rostrum nearly as long as head, black, pruinose; palpi black. Antennæ black throughout; flagellar segments short-oval with short verticils. Head light silvery grey in front, dark yellowish grey behind, this vaguely variegated with darker; anterior vertex relatively broad, fully twice the diameter of the first scapal segment.

Pronotum dark, sparsely pruinose. Mesonotum black, the surface sparsely grey to yellowish-grey pruinose, obscuring the shiny ground-colour; scutellum somewhat more heavily pruinose. Pleura heavily light grey pruinose. Halteres yellow, the knobs infuscated. Legs with the coxæ dark, sparsely pruinose, the extreme apices obscure yellow; remainder of legs black, the femoral bases obscure yellow, in some cases this colour including all but the tips. Wings with a whitish ground-colour, handsomely clouded with darker; wing-base more yellowish; wing-tip beyond the stigma and outer end of cell 1st M_2 infuscated; cell R_1 and the outer end of cell R before the stigma darkened, leaving the stigma white; narrow seams along the cord and vein Cu_1 ; conspicuous triangular marginal clouds in the ends of cells Cu , 1st A , and 2nd A ; a dusky wash in cell C near the end; veins dark brown with bullate areas along the cord. Venation: Sc short, Sc_1 ending opposite the origin of Rs , Sc_2 removed from its tip, Sc_1 alone a little shorter than $m-cu$; R_2 subtransverse, about three times Sc_2 beyond it; Rs arcuated, about one-half longer than the basal section of R_{4+5} ; $m-cu$ at or beyond the fork of M .

Abdomen black, pruinose; hypopygium dark, only the ventral dististyles light yellow. Male hypopygium with the basistyles larger than the ventral dististyle, the mesal lobe large, with long setæ. Ventral dististyle relatively small, the mesal face produced into a long stout rostral prolongation; spines two, long, straight, directed strongly basad, nearly equal in length, one arising from a large basal enlargement, the other from a smaller papilla placed on the side of the enlargement, the spines thus appearing slightly unequal; setæ of the style conspicuous, erect, becoming smaller and appressed to the apex; spines placed about one-half their length from apex of the prolongation. Dorsal dististyle unusually stout, gently curved to the obliquely acute apex. Gonapophyses black, the mesal lobe stout, the apex obliquely truncated to feebly bilobed, the margin microscopically denticulate. Ninth tergite with the caudal

margin very deeply notched, the lateral lobes blackened and having an outline that is approximately the same as the median notch. Ovipositor with the valves reddish horn-colour, tergal valves slender, gently upcurved to the acute tips.

Hab. Tasmania.

Holotype, ♂, Mt. Wellington, November 30, 1922 (*A. Tonnoir*).

Allotopotype, ♀.

Paratopotype, ♀; *paratypes*, 1 ♀, Cradle Valley, January 11, 1923; 1 ♂, 1 ♀, Mt. Field, December 21, 1922; 1 ♂, 1 ♀, Hartz Mts., December 10, 1922 (*A. Tonnoir*).

Dicranomyia albistigma is most closely allied to *D. remota*, Skuse, differing in the diagnostic characters outlined above.

Dicranomyia ochrirostris, sp. n.

General coloration reddish, the præscutum with a broad brown stripe; rostrum ochreous; halteres yellow, the knobs infuscated; wings with a strong brownish-yellow tinge, the stigma slightly darker brown; abdominal segments unicolorous; male hypopygium with the spines of the rostrum longer than prolongation alone.

Male.—Length 7·5–8 mm.; wing 9·3–9·5 mm.

Female.—Length 9–9·5 mm.; wing 10–11 mm.

Rostrum light ochreous; palpi dark brown. Antennæ relatively short, black, the basal segment of the scape restrictedly ochreous; flagellar segments oval. Head ochreous to light fulvous in front, somewhat paler on the genæ; posterior vertex infuscated. Vertex between the eyes narrow, less than the diameter of the first scapal segment.

Pronotum dark brown medially, paler laterally. Mesonotal præscutum shiny reddish with a broad dark brown median stripe, the interspaces indistinctly pruinose, the lateral margins of the sclerite obscure yellow; in some specimens the lateral stripes are faintly indicated; scutum reddish yellow, each lobe extensively infuscated; scutellum and postnotum brownish ochreous, the latter dark brown behind. Pleura yellowish ochreous, the central sclerites sometimes weakly infuscated. Halteres relatively short, yellow, the knobs dark brown. Legs with the coxæ greenish yellow; trochanters yellow; femora yellowish brown, the tibiæ and tarsi gradually darkening, the tips of the latter almost black. Wings with a strong brownish-yellow tinge, the costal region somewhat clearer yellow, the wing-tip a

little darker; stigma oval, slightly darker brown; veins brown, more yellowish in the costal region. Venation: Sc_1 ending opposite or shortly beyond the origin of R_s , Sc_1 a little shorter than $m-cu$; R_2 transverse, about one-half longer than Sc_2 beyond it; $m-cu$ at or beyond the fork of M .

Abdomen dark brown, the terminal segments and hypopygium obscure yellow; basal sternites more or less ochreous. Male hypopygium about as in *D. viridiventris*, Skuse; ventral dististyle very large, the rostral prolongation short, the two spines longer than the entire rostrum; spines straight, acute, the outer a trifle shorter than the inner, placed in a row, one being basal, the second inserted immediately beyond. Dorsal dististyle sickle-shaped, narrowed gradually to the long blackened apex. Mesal lobe of each gonapophysis strongly curved. Ninth tergite with a broad U-shaped notch, the lateral lobes with conspicuous setæ; a group of about five setæ on either side of the median line. Ovipositor with the valves relatively short, ending on a common level.

Hab. New South Wales, Tasmania.

Holotype, ♂, Cradle Valley, Tasmania, January 13, 1923 (*A. Tonnoir*).

Allotype, ♀, National Park, Tasmania, December 17, 1922 (*A. Tonnoir*).

Paratopotypes, 2 ♂♂, January 10-13, 1923; *paratypes*, 1 ♂, Wentworth Falls, Blue Mts., N.S.W., November 18, 1921; ♂, ♀, King River, Tasmania, February 4, 1923; 1 ♂, Hobart, Tasmania, November 8, 1922; 1 ♂, Mt. Wellington, Tasmania, November 27, 1922; 1 ♂, Fern Tree, Mt. Wellington, November 12, 1922 (*A. Tonnoir*).

Dicranomyia ochrirostris somewhat resembles *D. viridiventris*, Skuse, but is readily told by the large size and details of structure.

Dicranomyia substricta, sp. n.

General coloration light grey, the præscutum with three conspicuous brown stripes; antennæ black throughout; basal flagellar segments globular; halteres light yellow; wings milky with a sparse spotted and clouded darker pattern; male hypopygium with the spines of the rostral prolongation very long and slender, nearly straight.

Male.—Length about 5.5-5.8 mm.; wing 6.5-7 mm.

Female.—Length about 5.6 mm.; wing 6.5 mm.

Rostrum brown, the palpi a little darker. Antennæ dark brown throughout; flagellar segments globular, the outer

ones passing into short-oval, the verticils scarcely exceeding the segments in length. Head dark grey; vertex relatively narrow.

Pronotum dark above. Mesonotal præscutum light grey with three conspicuous brown stripes; pseudosutural foveæ represented by small circular black spots in the humeral region; scutum greyish, the lobes brown; scutellum light grey with a vague pale brown median stripe; postnotum dark brown, heavily light grey pruinose. Pleura dark brown, heavily light grey pruinose. Halteres of moderate length, light yellow; in the female slightly infuscated. Legs with the fore and middle coxæ dark, the posterior coxæ paler, grey pruinose; femora obscure yellow, the tips narrowly but faintly infuscated; tibiæ pale, the tips scarcely darkened; basitarsi elongate, more than twice as long as the remaining segments taken together, the basitarsi of the fore legs especially elongate. Wings with a pale milky tinge, sparsely clouded with darker; stigma oval, pale brown; a brown spot at tip of *Sc* and origin of *Rs*; cord and outer end of cell 1st *M*₂ seamed with greyish; vague dusky suffusions in the distal cells, in cells *R* and *M*, along vein *Cu*₁, in the Anal cells, and in the Anal angle of the wing; veins dark brown with conspicuous bullate areas along the cord. Venation: *Sc*₁ ending shortly beyond the origin of *Rs*, *Sc*₂ a short distance back from the tip, *Sc*₁ alone about one-half longer than *R*₂; *R*₂ subequal to vein *R*₁₊₂ and *Sc*₂ beyond it; *Rs* about two-thirds longer than the basal section of *R*₄₊₅; *m-cu* oblique, shortly before the fork of *M*.

Abdomen dark brown, the sternites dark grey; hypopygium paler. Male hypopygium with the basistyles unusually elongate, the outer face much longer than the ventral dististyle, with relatively few setæ; ventro-mesal lobe relatively conspicuous. Ventral dististyle fleshy, the rostral prolongation stout; spines very long, straight, placed close to the apex of the rostrum, nearly equal in length but the outer one appearing longer because placed on a basal tubercle that is more than twice the length of the tubercle of the slightly more basal spine. Gonapophyses large, the mesal lobe long and slender, the apex slightly curved. Ædeagus with conspicuous darkened basal plates. Ninth tergite relatively short, broad, the caudal margin evenly convex or with a weak median notch, with only a few scattered marginal setæ. Ovipositor with the valves relatively long and straight, the tergal valves a little exceeding the sternal valves, reddish horn-colour, their bases narrowly blackened.

Hub. Tasmania.

Holotype, ♂, Adventure Bay, December 24, 1922 (A. Tonnoir).

Allotype, ♀, Mt. Wellington, November 27, 1922.

Paratype, ♂, Eaglehawk Neck, Tasman Peninsula, November 16, 1922 (A. Tonnoir).

Dicranomyia inculta, sp. n.

General coloration grey, the præscutum with three brown stripes; femora light brown, the tips vaguely darker; wings tinged with grey with a sparse darker pattern; Sc_1 ending a short distance beyond the origin of R_s ; $m-cu$ a short distance before the fork of M ; abdomen dark brown; rostriform appendage of male hypopygium large, the two spines straight and of moderate length, basal in position; dorsal dististyle gently curved, the long tip acute.

Male.—Length about 6.2 mm.; wing 7.3 mm.

Rostrum short, dark brown. Antennæ broken. Head dark brownish grey, the anterior vertex reduced to a linear strip.

Pronotum dark brown. Mesonotal præscutum grey with a broad conspicuous median brown stripe, with short broad lateral stripes of the same colour; pseudosutural foveæ reduced to circular black pits that are very conspicuous against the grey background; scutum dark brown, the posterior lateral callosities light brown; scutellum and postnotum dark brown, sparsely pruinose. Pleura dark brown, heavily yellowish-grey pruinose. Halteres relatively long, pale, the base of the stem slightly infuscated. Legs with the coxæ and trochanters dark brown; femora light brown, the tips vaguely darker; tibiæ and tarsi darker brown. Wings with a greyish tinge, the stigma oval, a trifle darker; very indistinct pale brown spots at arculus, origin of R_s and tip of Sc , fork of R_s , the latter connected with the stigma and along the cord; veins dark brown. Venation: Sc_1 ending a short distance beyond the origin of R_s , Sc_2 about mid-distance between the origin of R_s and the tip of Sc_1 ; R_2 subequal to vein R_{1+2} and Sc_2 beyond it, the latter portion strongly incurved to the costa; R_s arcuated, about one-half longer than the basal section of R_{4+5} ; cell 1st M_2 relatively long, rectangular, about as long as the outer section of M_3 ; $m-cu$ about one-half its length before the fork of M .

Abdominal segments dark brown; ventral dististyle of hypopygium paler. Male hypopygium with the mesal lobe of the basistyle relatively stout. Ventral dististyle relatively small, fleshy, the rostral prolongation very large, the two spines subequal in size, nearly basal in position, straight.

their tips acute; apex of rostrum with a few small setæ, the entire surface with scattered microscopic setulæ. Dorsal dististyle elongate, only gently curved, the apex long, nearly straight. Gonapophyses with the lateral blades dusky, the mesal lobe paler with the tip narrowly obtuse. Ninth tergite broad, the caudal margin rounded.

Hab. Victoria.

Holotype, ♂, Ferntree Gully, Dandenong Range, October 25, 1921 (*A. Tonnoir*).

Allied to *Dicranomyia obscura*, Skuse.

Dicranomyia wellingtonia, sp. n.

Mesonotum shiny brownish black, the lateral margins paler; antennæ black throughout; anterior part of vertex silvery; halteres elongate; wings cuneiformly narrowed at base, conspicuously tinged with brown, the stigma not darker; *Sc* short, *Sc*₁ long; cell 2nd *A* relatively narrow; abdominal tergites uniformly dark brown; rostral prolongation of male hypopygium with the spines very unequal in shape, widely separated from one another.

Male.—Length about 5.5 mm.; wing 6.5 mm.

Female.—Length about 5.8 mm.; wing 6.8 mm.

Rostrum very short, whitish; palpi small, dark brown. Antennæ black throughout; flagellar segments oval, with moderately long verticils. Anterior part of vertex silvery pruinose; remainder of vertex dark brown, fading into obscure brownish yellow on the occiput; vertex between the eyes broad.

Mesonotal præscutum with three dark brown to brownish-black shiny confluent stripes, the humeral regions and narrower lateral margins brownish yellow; scutal lobes brownish black; postnotum dark, the scutellum and median area of scutum paler. Pleura pale yellow testaceous. Halteres elongate (1.25 mm.), dark brown, only the extreme base slightly paler. Legs with the coxæ and trochanters greenish; femora pale testaceous, soon passing into dark brown; tibiæ and tarsi dark brown. Wings cuneiformly narrowed at base, conspicuously tinged with brown, the stigma concolorous but indicated by a delicate discoloured margin; veins brownish black, the short macrotrichiæ concolorous. Venation: *Sc*₁ ending opposite or just beyond the origin of *Rs*, *Sc*₂ some distance from its tip, *Sc*₁ alone varying from about two-thirds to nearly as long as *Rs*; *R*₂ about twice *Sc*₂ beyond it, both pale; cell 1st *M*₂ closed; *m-cu* before or close to the fork of *M*; cell 2nd *A* relatively narrow.

Abdominal tergites uniformly dark brown; sternites pale; hypopygium dark. Male hypopygium with the ninth tergite broadly notched medially, the lateral lobes rounded, darkened, and provided with coarse setæ. Basistyles relatively large, the mesal face produced into two lobes, one larger than the other, both conspicuously setiferous. Ventral dististyle rather small, fleshy, the rostriform prolongation stout, broad-based, with two spines, the more basal being about three times as long as the small outer spine, the two separated from one another by a distance about equal to the length of the smaller spine; apex of rostrum with several spinous setæ. Dorsal dististyle a curved sickle-shaped rod that narrows gradually to the acute blackened point. Gonapophyses with the mesal lobe long, acute. Ædeagus of moderate length. Ovipositor with the tergal valves long and nearly straight, dark horn-colour.

Hab. Victoria, Tasmania.

Holotype, ♂, Mt. Wellington, Tasmania, November 25, 1922 (*A. Tonnoir*).

Allotype, ♀, Fern Tree, Mt. Wellington, November 10, 1922.

Paratype, 1 ♂, with the allotype; 1 ♂, Adventure Bay, Tasmania, December 25, 1922; 1 ♂, Sassafras, Dandenong Range, Victoria, October 19, 1922 (*A. Tonnoir*).

The present species and the next, *Dicranomyia æquispina*, sp. n., are allied to *D. cuneata*, Skuse.

Dicranomyia æquispina, sp. n.

Male.—Length about 5 mm.; wing 6·2 mm.

Closely related to *D. wellingtonia*, sp. n., in the silvery anterior vertex, elongate halteres, and other features, differing as follows:—

The silvery anterior vertex is bordered behind by a transverse black area, the remainder of the vertex and the occiput dark brown. Pronotum dark brown. Præscutum not blackened, shiny reddish, with faint greenish tints. Wings with *Sc*₁ longer, about four-fifths of *Rs*; *m-cu* at fork of *M*. Male hypopygium with the mesal face of the basistyle with two unequal fleshy lobes, as in *wellingtonia*. Rostral prolongation of the ventral dististyle with two slender spines, the more basal only a trifle longer and stouter than the distal spine, the two placed close together, the distance between them at base less than a quarter of the length of the shortest.

Hab. Tasmania.

Holotype, ♂, National Park, December 16, 1922 (*A. Tonnoir*).

Dicranomyia flagellifer, sp. n.

Rostrum and antennæ dark brown; mesonotum yellowish pollinose, the præscutum with three brown stripes; pleura dark brown, with longitudinal stripes of sparse yellow pollen; legs with the femora obscure brownish yellow, the tips narrowly darkened; wings with a pale brown tinge, heavily variegated with darker brown seams; *m-cu* more than its length before the fork of *M*; male hypopygium with the spines of the rostral prolongation very elongate and unequal in size.

Male.—Length about 7–7.5 mm.; wing 8.2–9.2 mm.

Rostrum short, dark brown; palpi brownish black. Antennæ relatively short, dark brown throughout; flagellar segments oval, the verticils rather short. Head dark brownish grey; anterior vertex clearer grey, reduced to a linear strip.

Pronotum dark brown. Mesonotal præscutum yellowish pollinose with a broad conspicuous dark brown median stripe, that is sometimes indistinctly split medially, and more abbreviated lateral stripes; median stripe expanded at cephalic margin of sclerite; lateral margins of præscutum more or less infuscated; pseudosutural foveæ inconspicuous; scutal lobes dark brown, the median area yellowish pollinose; scutellum and postnotum brown with a sparse yellowish-grey pollen. Pleura dark brown with two longitudinal stripes of sparse yellow pollen, giving a striped appearance. Halteres with the stem light yellow, the knobs weakly infuscated, the extreme apex pale. Legs with the coxæ brown, sparsely pollinose; trochanters brownish yellow; femora obscure brownish yellow, the tips narrowly and indistinctly darkened; tibiæ light brown, the tips narrowly darker; basal tarsal segments pale brown, their tips darker; terminal segments brownish black. Wings with a pale brown tinge, the surface extensively variegated with slightly darker brown seams; stigma long-oval, pale brown; an arcular dark spot; a small spot at tip of *Sc* and origin of *Rs*; broad seams at fork of *Rs*, along cord and outer end of cell 1st *M*₂; wing-apex in the radial cells similarly darkened; a dusky cloud in cell *M* along vein *Cu*₁ and others in the Anal cells adjoining vein 2nd *A*; veins brown, paler in the costal area, with bullate areas along the cord and outer end of cell 1st *M*₂. Venation: *Sc*₁ ending slightly beyond the origin of *Rs*, *Sc*₂ opposite or just beyond this origin; *R*₁ about twice *Sc*₂ beyond it; *Rs* about one-third longer than the basal section of *R*₄₊₅, gently arcuated;

vein $R_1 + Sc_2$ arched in the stigmal region; cell 1st M_2 closed, m a little shorter than the outer deflection of M_3 ; $m-cu$ more than its own length before the fork of M .

Abdomen dark brown, the hypopygium brownish ochreous. Male hypopygium with the mesal lobe of the basistyle relatively large. Ventral dististyle fleshy, the mesal face produced into a stout rostral prolongation that bears two very conspicuous spines, the more basal about as long as the dorsal dististyle, the basal third swollen, the apex produced into a long gently curved spine that is directed basad; outer spine about one-half the length of the other, the base slightly enlarged, thence extended into a long acute spine. Dorsal dististyle large, rather strongly curved, the tip acute. Gonapophyses with the mesal lobe unusually slender, appearing as a blackened rod with the tip acute.

Hab. New South Wales, Tasmania.

Holotype, ♂, Fern Tree, Mt. Wellington, Tasmania, November 12, 1922 (*A. Tonnoir*).

Paratype, ♂, Mt. Wilson, Blue Mts., N.S.W., November 19, 1921 (*A. Tonnoir*).

Geranomyia tonnoiri, sp. n.

Præscutum dull reddish brown with three conspicuous dark brown stripes; pleura dark brown, the ventral pleurites more reddish brown, pruinose; knobs of halteres infuscated; femora brownish yellow; wings with a brownish tinge, the radial field whitish subhyaline, the pattern heavy; male hypopygium with the spines of the rostral prolongation long and slender, exceeding the entire rostrum.

Male.—Length (excluding rostrum) about 7.5 mm.; wing 8.2 mm.; rostrum 4.2 mm.

Female.—Length (excluding rostrum) about 8 mm.; wing 8.3 mm.; rostrum 4.3 mm.

Rostrum elongate, if bent backward extending to about one-third the length of the abdomen, black; palpi apparently three-segmented. Head dark grey, blackish adjoining the eyes, the anterior vertex clearer grey; anterior vertex narrow.

Pronotum dark greyish brown. Præscutum dull reddish brown with three conspicuous dark brown stripes, the median stripe broadened behind; median area of scutum narrowly infuscated, the stripe continued caudad on to the scutellum; scutal lobes extensively infuscated; scutellum brownish ochreous, variegated with brown, as above; postnotum dark brown. Pleura dorsally dark greyish brown, the sternopleurite and meron more reddish brown, pruinose.

Halteres pale, the knobs infuscated. Legs with the coxæ reddish ochreous, the fore coxæ more infuscated; trochanters obscure yellow; femora brownish yellow; tibiae pale brown, gradually darkening beyond the base; tarsi passing into black. Wings with a brownish tinge, cell *C* and especially *Sc* more infuscated; cells *R*, *Sc*₁, *R*₁, *R*₂, and bases of the Anal cells more whitish subhyaline; wing conspicuously variegated with brown markings and paler clouds; the brown areas include the anterior prearcular cells; a conspicuous quadrate area at origin of *Rs*, not reaching *M* or *C*; the oval stigma, slightly connected with a small spot at fork of *Rs*; narrow seams along cord and outer end of cell 1st *M*₂; ends of cells *R*₂ and *R*₃ infumed; a broad brown seam along vein *Cu*₁ in cell *M*; veins dark brown, paler in the subhyaline areas; macrotrichia short, brownish black. Venation: *Sc*₁ ending opposite or before mid-length of *Rs*, *Sc*₂ about twice its length from tip; *R*₂ in virtual transverse alignment with the tip of *Sc*₂, *R*₁ thus being barely preserved; *Rs* relatively short, square and spurred at origin; *m* shorter than the outer deflection of *M*₃, straight; *m-cu* before the fork of *M*.

Abdomen dark brown above, basal sternites indistinctly bicolorous, the caudal half obscure dirty yellow, the bases dark. Male hypopygium with the mesal lobe of the basistyle relatively long, yellow, setiferous. Ventral dististyle large and fleshy, the rostral prolongation slender, the two spines placed near mid-length, long, slender, curved gently basad, nearly equal in length and longer than the entire rostrum; apex of rostrum with a few scattered setae. Dorsal dististyle strongly curved, sickle-shaped, the apex suddenly narrowed to the acute tip. Gonapophyses with the mesal lobe relatively short and stout, broad, the apex narrowly darkened. Aedeagus with the subtending tubercles conspicuous, spinous or nearly so. Ovipositor with the valves horn-coloured, the tergal valves slender, nearly straight, the tips obtuse.

Hab. New South Wales.

Holotype, ♂, Wentworth Falls, Blue Mts., November 18, 1921 (*A. Tonnoir*).

Allotopotype, ♀.

This interesting *Geranomyia* is named in honour of the distinguished collector Dr. André L. Tonnoir. There is some question as to the exact number of palpal segments.

Geranomyia (Triphana) hardyi, sp. n.

General coloration reddish ochreous, the præscutum with brown stripes, the pleura dark; legs uniform in colour; wings tinged with yellow, with conspicuous brown marks and clouds; a supernumerary cross-vein in cell *Sc*; *m* long, arcuated, longer than the outer deflection of *M*₃; abdomen dark brown; male hypopygium with the rostral prolongation small, the spines long and straight.

Male.—Length (excluding rostrum) about 6.5–7.5 mm.; wing 7.6–10 mm.; rostrum 2.5 mm.

Female.—Length (excluding rostrum) 8.5 mm.; wing 8.4–10.5 mm.; rostrum about 2.5 mm.

Rostrum black throughout, relatively short, as shown by the measurements; palpi 3-segmented, black. Antennæ black throughout; flagellar segments oval. Head dark, sparsely pruinose, the anterior vertex lighter grey, vertex reduced to a narrow strip.

Pronotum dark medially, the sides obscure yellow. Mesonotal præscutum light reddish ochreous, with a median stripe that is at least indicated anteriorly; in darker specimens with three præscutal stripes; scutal lobes infuscated to ochreous, the scutellum and a median area on the mediotergite darker. Propleura and the anterior portions of the sternopleurite and anepisternum dark brown; pleurotergite less strongly infuscated; remainder of the pleura ochreous. Halteres yellow, the knobs dark brown. Legs with the fore coxæ dark brown, the remaining coxæ and the trochanters yellow; femora obscure yellow, the tips not darkened; remainder of legs brownish yellow, the terminal tarsal segments passing into dark brown. Wings with a pale yellow tinge, the costal region clearer; disk with a conspicuous brown and grey pattern; a triangular to circular brown spot at origin of *Rs*, including cell *Sc* but scarcely reaching *M*; stigma oval, brown, connected with a brown cloud at the fork of *Rs*, the cord thence narrowly seamed with brown, broadened into a conspicuous cloud on *m-cu* and the distal section of *Cu*₁; small brown clouds at the supernumerary cross-vein in cell *Sc*, *Sc*₂, and at base of vein *M*; paler clouds in cell *C* above the origin of *Rs*; a large one in end of cell 1st *A* opposite the origin of *Rs*; anal region darkened; brown clouds at fork of *M*₁₊₂ and on the outer deflection of *M*₃; wing-tip extensively darkened; very pale washes along vein *Cu*₁ in cell *M* and along the margin of cell 2nd *A*; veins pale, darker in the infuscated

areas. Venation: *Sc* long, *Sc*₁ ending opposite two-thirds the length of *Rs*, *Sc*₂ not far from its tip; *R*₂ a trifle longer than *Sc*₂ beyond it; *Rs* angulated and spurred at origin; vein *R*₁+*Sc*₂ arched in the stigmal region; cell 1st *M*₂ elongate; *m* longer than the outer deflection of *M*₃, arcuated; *m-cu* close to the fork of *M*, variable in position; a supernumerary cross-vein in cell *Sc* at near one-third the length.

Abdomen, including hypopygium, dark brown. Male hypopygium with the mesal lobe of the basistyle stout and of moderate length, with long setæ. Ventral dististyle large and fleshy, the rostral prolongation small, slender, more or less constricted at base forming a neck, the two spines placed close together just beyond the neck, long, straight, much longer than the rostrum beyond it; apex of rostrum with about four long setæ. Dorsal dististyle straight basally, the apex curved, the extreme tip acute. Gonapophyses with the mesal lobe elongate, the tip acute and gently curved, the lateral edge irregularly crenulate. Ædeagus with basal setæ; surface before apex with small tubercles. Ninth tergite narrow, the caudal margin with a small shallow median notch.

Hab. Tasmania.

Holotype, ♂, Mt. Wellington, November 27, 1922 (*A. Tonnoir*).

Allotopotype, ♀.

Paratopotypes, 1 ♂, 1 ♀, November 25 to December 2, 1922; *paratypes*, 1 ♂, Wilmot, January 8, 1923 (*A. Tonnoir*); 1 ♂, Adventure Bay, December 30, 1922; 1 ♂, Hartz Mts., December 10, 1922 (*A. Tonnoir*); 1 ♀, Hobart (*G. H. Hardy*), in the collection of Queensland University.

This interesting *Geranomyia* is named in honour of Mr. G. H. Hardy, to whom I am greatly indebted for many interesting crane-flies from Eastern Australia and Tasmania.

Geranomyia (Triphana) tenebricosu, sp. n.

General coloration brownish black, the posterior sclerites of the notum and the pleura pruinose; femora yellow, the tips conspicuously dark brown; wings yellowish grey with a sparse pale brown pattern; no supernumerary cross-vein in cell *Sc*; *Rs* arcuated at origin; male hypopygium with the rostriform prolongation elongate, the spines short, sub-basal in position.

Male.—Length (excluding rostrum) about 8 mm.; wing 8.5 mm.; rostrum about 1.7 mm.

Rostrum unusually short, as shown by the measurements, about equal in length to the thorax alone, black throughout; palpi black. Antennæ with the basal segment very long, equal to the succeeding three taken together, black, the flagellum brownish black; flagellar segments elongate-oval, the terminal segment a trifle longer than the intermediate segments. Vertex between the eyes very narrow, head grey with a \uparrow -shaped black marking on the posterior vertex, the stem broader, the arms suborbital in position.

Pronotum shiny black above, paler laterally, the margins slightly pruinose. Mesonotum brownish black, sparsely pruinose; humeral region of the præscutum slightly paler; scutum and postnotum more heavily pruinose. Pleura brownish black, conspicuously pruinose. Halteres with the stem pale, the knobs strongly infuscated. Legs with the coxæ infuscated, pruinose; trochanters obscure yellow; femora obscure yellow, the base brighter, the tips broadly and conspicuously dark brown; tibiæ brownish yellow, the tips narrowly infuscated; tarsi light brown, the terminal segments passing into black. Wings with a pale yellowish-grey tinge, cell *Sc* somewhat darker; conspicuous pale brown clouds at origin of *Rs*, scarcely reaching *C* or *M*; a large circular spot at end of *Sc*; stigma oval, not connected with the spot at fork of *Rs*; cord and outer end of cell 1st *M*₂ conspicuously seamed, the former extending to the end of *m-cu*; pale clouds along vein *Cu*₁ in cell *M*; brown washes in the outer end of cell 1st *A* and in the anal angle of cell 2nd *A*; veins darker brown, those in the costal region paler, more infuscated in the clouded areas; macrotrichiæ short, dark brown. Venation: *Sc* long, *Sc*₁ ending about opposite two-thirds the length of *Rs*, *Sc*₂ not far from its tip; *R*₁ distinctly preserved, nearly as long as the free tip of *Sc*₂, angularly bent into *R*₂, the latter about twice the free tip of *Sc*₂; *m* shorter than the outer deflection of *M*₂, arcuated; *m-cu* before the fork of *M*.

Abdomen dark brown, the basal sternites paler. Male hypopygium with the mesal lobe of the basistyle short and very broad, with a smaller caudal lobule. Ventral dististyle large and fleshy, the rostral prolongation long, the spines nearly basal in position, small, straight, spicate, placed close together, slightly unequal, the apex of the rostrum beyond them about twice the length of a single spine, the apex produced into a small cone with several setæ on the face and distal third, the apical setæ larger. Dorsal dististyle rather strongly curved, the tip acute. Gonapophyses with the mesal lobe only moderately produced, the apex narrowly

blackened. *Ædeagus* setiferous at base, before the apex with numerous small tubercles.

Hab. Tasmania.

Holotype, ♂, Wilmot, January 8, 1923 (*A. Tonnoir*).

Geranomyia (Triphana) victoriæ, sp. n.

General coloration reddish ochreous, the præscutum with a median brown stripe; fore coxæ yellowish ochreous, concolorous with the other coxæ; legs obscure yellow; wings tinged with yellow, with a conspicuous brown pattern that is not as extensive as in *G. (T.) hardyi*, sp. n.; no supernumerary cross-vein in cell *Sc*; male hypopygium with the rostral prolongation short, the spines straight.

Male.—Length (excluding rostrum) 6·8 mm.; wing 8·3 mm.; rostrum about 2 mm.

Rostrum brownish black, relatively short; palpi black. Antennæ black throughout; flagellar segments oval. Head with the anterior vertex narrowed to a mere strip; posterior vertex dark brownish grey with a series of about three velvety-black spots on the median line.

Pronotum dark brown medially, dark brown laterally. Mesonotal præscutum light reddish ochreous, the median area broadly infuscated, the stripe not reaching the suture; lateral stripes vaguely indicated; scutal lobes extensively infuscated, the median area and centre of the scutellum almost whitish; remainder of scutellum a little darker; postnotum reddish ochreous, darker behind. Pleura slightly infuscated. Halteres pale, the knobs weakly infuscated. Legs with the coxæ yellowish ochreous; trochanters yellow; femora obscure yellow, not darkened apically; tibiæ and tarsi brownish yellow, not darkened, the terminal tarsal segments passing into black. Wings tinged with yellow, conspicuously patterned with brown; small dark spots at base of cell *Sc* and origin of *Cu*₁; a triangular area at origin of *Rs*, scarcely reaching *M*, much paler in cell *C*; a small spot on *Sc*₂; stigma large, oval, connected with a circular cloud at the fork of *Rs*; cord and outer end of cell 1st *M*₂ narrowly seamed with brown, this is not continued beyond *m-cu*; a vague dusky clouding in the end of cell 1st *A* opposite the origin of *Rs*; wing-tip scarcely infuscated; veins pale, darker in the infuscated areas. Venation: *Sc* long, *Sc*₁ ending about opposite two-thirds the length of *Rs*, *Sc*₂ longer and at its tip; *R*₂ about one-half longer than the distal section of *Sc*₂; *Rs* angulated and weakly spurred at origin, the distal section long and straight; *m* gently

arcuated, slightly longer than the outer deflection of M_3 ; $m-cu$ before or near the fork of M ; no supernumerary cross-vein in cell Sc .

Abdomen dark brown, the hypopygium reddish ochreous. Male hypopygium of the type of *G. hardyi*, sp. n.; rostral prolongation of the ventral basistyle short, the two spines short, straight, reddish brown, placed on elevated tubercles, the apex of the rostrum beyond the spines only slightly produced, the entire rostrum scarcely longer than the spines. Dorsal dististyle rather strongly curved beyond mid-length, the basal half straight, the apex suddenly narrowed into a slender spine. Gonapophyses with the mesal lobe blackened at tip, the lateral margin microscopically serrulate. Ninth tergite without apparent caudal notch.

Hab. Victoria.

Holotype, ♂, Sassafras, Dandenong Range, October 19, 1922 (*A. Tonnoir*).

Paratopotype, ♂, October 21, 1922 (*A. Tonnoir*).

Geranomyia victoriæ is readily told from *G. hardyi*, sp. n., by the lack of a supernumerary cross-vein in cell Sc , the more restricted wing-pattern, and differences in the structure of the male hypopygium.

Rhipidia mutila, sp. n.

Rostrum longer than the head; antennæ (♂) long-bipectinate; præscutum dark brown with three reddish-brown pollinose stripes; wings yellowish brown, the stigma full, dark brown; paler brown clouds along the cord, at fork of M_{1+2} , and as a seam along vein Cu_1 ; cell 1st M_2 open by the atrophy of the outer deflection of M_3 ; cell 2nd M_2 only a trifle longer than its petiole; abdominal segments bicolorous, their apices pale; male hypopygium with the rostral prolongation bispinous, the spines short, straight, separated at base, nearly equal in size; gonapophyses pale, the tips narrowly obtuse.

Male.—Length about 5.5 mm.; wing 6.8 mm.

Rostrum relatively elongate; longer than the remainder of the head, dark brown; palpi brownish black. Antennæ (♂) long-bipectinate, this including all the flagellar segments except the last; longest branches approximately three times as long as the segment, each tipped with a long seta; scape dark brown; flagellar segments except the last bicolorous, the basal half or more, together with the branches, dark brown, the glabrous apical pedicel pale; terminal segment simple, uniformly dark. Head black, heavily grey

pruinose, the median area more destitute of bloom; anterior vertex narrow.

Mesonotal præscutum dark brown, the usual stripes paler, more reddish brown, covered with a sparse pollen; scutum with the lobes brownish black, the centre of each lobe sparsely pruinose, the median area and the scutellum grey; postnotum black, grey pruinose. Pleura dark brown, grey pruinose, with a conspicuous dorsal glabrous stripe of the ground-colour, this ending beneath the level of the wing-base. Halteres pale yellow, the knobs a trifle darker. Legs with the coxæ dark, sparsely pruinose; trochanters brownish yellow; femora brown, the tips darker brown; tibiæ dark brown, the tips narrowly darker; tarsi passing into brownish black. Wings with a yellowish-brown tinge, variegated with brown; stigma oval, brown; rather broad and extensive pale brown clouds along the cord and at the fork of M_{1+2} ; a brown seam along Cu_1 ; veins dark brown, the macrotrichia sparse, still darker brown. Venation: Sc of moderate length, extending to nearly opposite mid-length of the rather short and gently arcuated R_s , Sc_2 not far from the tip of Sc_1 ; R_2 nearly destitute of macrotrichia, pale; cell 1st M_2 open by the atrophy of the outer deflection of M_3 , cell 2nd M_2 being only a trifle longer than its petiole; $m-cu$ close to the fork of M .

Abdominal tergites conspicuously bicolorous, the base broadly dark brown, the caudal margins of the segments with a broad yellowish triangle that sends an anterior-median point cephalad; sternites even more extensively obscure yellow; hypopygium dark brown, the ventral dististyle paler. Male hypopygium with the mesal face of the basistyle produced caudad and mesad into a long oval lobe that is strongly darkened and provided with numerous long setæ. Ventral dististyle pale, fleshy, the rostral prolongation long, stout at base, the two spines pale and separated at base, the outer spine a trifle longer than the inner; rostrum before the spines with numerous setæ; apex of the rostrum beyond the spines provided with microscopic setæ. Dorsal dististyle a strong blackened rod, the tip suddenly narrowed and decurved. Gonapophyses with the tips pale and narrowly obtuse.

Hab. Tasmania.

Holotype, ♂, Strahan, February 5, 1923 (*A. Tonnoir*).

Cell 1st M_2 is open in both wings of the unique type and the character must be presumed to be normal for the species. The fly is abundantly distinct from the species next to be described.

Rhipidia pallidistigma, sp. n.

Male.—Length about 6·5 mm. ; wing 8·2 mm.

Female.—Length about 8 mm. ; wing 10 mm.

Characters generally as in *R. mutila*, sp. n., differing as follows :—

Rostrum short, much shorter than the remainder of the head. Pectinations of antennæ (♂) somewhat shorter, the longest approximately two and one-half times the length of the segment. In the female, the antennal segments are long-unipectinate, the branch about as long as the segment, each branch terminating in two setæ.

Mesonotum light grey pruinose on a dark brown background, the præscutum with a darker brown median stripe. Pleura dark brown, grey pruinose. Halteres short, pale, the knobs infuscated, the stem fringed with setæ. Legs with the coxæ dark brown, sparsely pruinose; trochanters yellowish brown; femora yellowish brown with a broad terminal or narrower subterminal dark ring; tibiæ brown, the tips passing into dark brown; basal two tarsal segments brown, the tips narrowly darkened, the terminal tarsal segments uniformly brownish black. Wings tinged with yellow, the costal region more saturated; stigma elongate-oval, pale brown, the margins darker, the centre almost hyaline, the outer end dark; cord and outer end of cell 1st M_2 vaguely seamed with darker. Venation: Sc_1 ending opposite one-third to two-fifths the length of the angularly bent Rs , Sc_2 not far from its tip; R_2 transverse, a little longer than the oblique Sc_2 beyond it; cell 1st M_2 closed, the petiole of cell 2nd M_2 comparatively short, a little more than one-half the cell.

Abdomen dark brown, indistinctly bicolorous, the pattern reversed from that of *R. mutila*; basal median areas of the segments paler, the caudal margins broadly dark brown; hypopygium paler. Male hypopygium with the mesal lobe of the basistyle shorter and not darkened. Ventral dististyle with the rostral prolongation subchitinized and nearly glabrous, before the spines narrowed into a neck, the spines long, slender, curved, placed close together about their own length from the tip of the rostrum. Dorsal dististyle sickle-shaped, the apex suddenly narrowed to an acute point. Gonapophyses conspicuously darkened, the mesal lobe acute at apex. Ovipositor with the tergal valves relatively short, upcurved to the acute tips; sternal valves long, stout, the bases blackened:

Hab. Tasmania.

Holotype, ♂, National Park, December 16, 1922 (*A. Tonnoir*).

Allotype, ♀, Mt. Farrel, February 9, 1923 (*A. Tonnoir*).

Paratopotype, 1 ♂; *paratypes*, 2 ♂♂, 1 ♀, Adventure Bay, Dec. 24-31, 1922 (*A. Tonnoir*).

Rhipidia pallidistigma funeralis, subsp. n.

Female.—Length 7.5 mm.; wing 9 mm.

Resembling the typical form, but the general coloration black, the præscutum with only a sparse bloom, the postnotum and pleura more heavily pruinose. Knobs of the halteres blackened. Femora with the tips broadly blackened, especially the fore femora where the outer two-thirds is blackened; tibiæ and tarsi black, the posterior basitarsus with the proximal half reddish brown. Wings with a dusky tinge, the stigma barely indicated except along the cephalic and distal margins. Abdomen uniformly blackened, the base of the ovipositor reddish brown, the valves still darker; bases of the sternal valves conspicuously blackened.

Hab. New South Wales.

Holotype, ♀, Wentworth Falls, Blue Mts., November 18, 1921 (*A. Tonnoir*).

Orimargula tasmanica, sp. n.

General coloration grey, the præscutum more infuscated; antennal segments subglobose; legs dark brown; wings with a pale brown tinge, the disk heavily spotted with brown; cell M_3 sessile or nearly so.

Male.—Length about 5.5 mm.; wing 6.8 mm.

Rostrum light brown; palpi dark brown. Antennæ black throughout, relatively short; flagellar segments subglobose, with short verticils. Anterior vertex dark, the posterior vertex and occiput paler brown.

Mesonotum greyish brown, clearer grey on the posterior portion of the præscutum, the median area of the scutum, and the scutellum; postnotum dark, grey pruinose. Pleura heavily light grey pruinose. Halteres pale, the knobs yellow. Legs with the coxæ light grey; trochanters brown; remainder of legs dark brown, the femoral bases paler, the terminal tarsal segments darker. Wings with a pale brown tinge, the disk rather heavily spotted with darker brown; stigmal blotch large, connected with the spot at fork of R_s ; a spot near mid-length of R_3 ; conspicuous clouds along the posterior cord and on *m-cu*. Venation: cell M_3 sessile or

Abdomen dark brown, heavily grey pruinose, the hypopygium paler. Male hypopygium with the basistyles long, cylindrical, unarmed; dististyles two in number, closely connected or slightly fused at base; outer dististyle a pale, flattened, cultriform blade that is a little shorter than the inner style, the latter with dense spinous setæ at apex, the mesal face with fewer and more scattered setæ, these becoming microscopic at base.

Hab. Tasmania.

Holotype, ♂, Wilmot, January 8, 1923 (*A. Tonnoir*).

Orimargula tasmanica is allied to *O. australiensis*, Alexander (N. Queensland), differing in its larger size, heavily spotted wings, and sessile or subsessile cell M_3 .

Elephantomyia tasmaniensis, sp. n.

Rostrum fully as long as the body; anterior vertex clear grey; mesonotum brown, the humeral region of the præscutum more ochreous; legs dark brown; wings with a brown tinge, with sparse darker brown seams; *m* obliterated by the fusion of the outer deflection of M_3 on M_{1+2} , closing cell 1st M_2 .

Male.—Length (excluding rostrum) about 7.5 mm.; wing 9.6 mm.; rostrum about 7.8 mm.

Rostrum long and slender, a trifle longer than the remainder of the body, dark brown throughout, including the palpi. Antennæ dark brown, the apex of the second scapal segment obscurely paler; scapal segments small; flagellar segments cylindrical, the basal segments short, gradually lengthening, the terminal segment longest; all flagellar segments beyond the first with long verticils, these becoming longer on the intermediate and outer segments; only eleven segments present, the basal five segments about equal to the following two combined but not enlarged. Head clear light grey in front, the vertex more infuscated behind; anterior vertex narrow, only a trifle wider than the second scapal segment.

Pronotum and cervical sclerites dark brown above, ochreous brown laterally. Mesonotum brown, the humeral region more ochreous brown; median stripe brown and somewhat darker than the lateral stripes; scutum brownish ochreous, the centres of the lobes conspicuously dark brown; scutellum testaceous-brown; postnotum dark brown, sparsely pruinose. Pleura with the sternopleurite and anepisternum dark brown, sparsely pruinose, the pteropleurite pale, the pleurotergite pruinose, the general effect produced being a

dark brown pleura with a narrow pale transverse stripe extending from the hind coxæ to the wing-root. Halteres pale, the knobs dark brown. Legs with the coxæ dark, pruinose; trochanters brownish yellow; femora dark brown, the bases narrowly paler; tibiæ and tarsi dark brown; no evident tibial spurs; femora and tibiæ with appressed setæ and scattered erect larger bristles. Wings with a brown tinge, rather conspicuously clouded with darker brown; stigma long-oval, slightly darker brown; extensive dusky clouds at origin of R_s , along the cord and outer end of cell 1st M_2 ; wing-tip and vein Cu_1 seamed with brown; an oval pale area in the prearcular cell; veins dark brown; macrotrichiæ short and sparse, dark brown. Series of trichiæ on the serial vein R_{2+3+4} and R_4 , and on the distal section of R_5 , longer and more delicate on the medial veins beyond the cord. Venation: Sc_2 longer than Sc_1 , extending to just beyond the fork of R_s , the latter square and long-spurred at origin; cell 2nd M_2 narrowly sessile or short-petiolate, the basal deflection of M_3 occupying the entire outer end of cell 1st M_2 , completely obliterating m ; $m-cu$ at about two-thirds the length of cell 1st M_2 , longer than the distal section of Cu_1 ; anterior arculus pale but indicated.

Abdomen yellowish brown, the segments narrowly margined laterally and caudally with brown; subterminal segments entirely dark brown; hypopygium obscure brownish yellow.

Hab. Tasmania.

Holotype, ♂, Mt. Farrel, February 8, 1923 (*A. Tonnoir*).

Elephantomyia tasmaniensis is allied to *E. ruapehuensis*, Alexander (New Zealand), in the spurless tibiæ and general appearance. The species should not be placed in *Elephantomyodes*, and, because of their spurless tibiæ, a new subgeneric group may eventually be required for their reception.

Elephantomyia tasmaniensis tasmaniensis, subsp. n.

Male.—Length (excluding rostrum) 7·5–8 mm.; wing 8–9 mm.; rostrum alone about 7–7·5 mm.

Female.—Length (excluding rostrum) 10–11 mm.; wing 10–10·8 mm.; rostrum 7–7·5 mm.

Closely resembling the typical form, differing especially in the more uniformly darkened pleura, the heavier wing-pattern, and other details of coloration.

This series allows us to make more definite statements regarding the range of variation in the species.

Rostrum shorter than the body in both sexes. Median præscutal stripe entire to weakly divided. Pleura in most cases uniformly darkened, pruinose. Wing-pattern heavy and conspicuous, most of the longitudinal veins being seamed with darker. Venation: *Rs* angulated with a short to longer spur; cell 2nd *M*₂ usually short-petiolate, in rare instances sessile; *m-cu* beyond mid-length of cell 1st *M*₂, usually at near two-thirds the length. Abdominal tergites more uniformly dark brown.

Hab. New South Wales.

Holotype, ♂, Barrington Tops, January 1925 (*Sydney Univ. Zool. Exp.*); type in the Macleay Collections, U. of S.

Allotopotype, ♀.

Paratopotypes, 4 ♂ ♀.

LXXI.—*A new Species of Schizotænia [Cestoda] from the Capybara.* By H. A. BAYLIS, M.A., D.Sc.

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ONE species of the genus *Schizotænia* has already been recorded from the South-American rodent *Hydrochærus capybara*. This is *S. hagmanni*, v. Janicki, 1906, which, according to Baer (1927), is a synonym of *S. decrescens* (Diesing, 1856), and is therefore a parasite also of peccaries (*Dicotyles* spp.).

Through the kindness of Dr. L. E. Migone the British Museum (Natural History) has received two specimens of a cestode from the capybara, obtained in Paraguay. On examination these prove to belong to the genus *Schizotænia*, but to a species quite distinct from *S. decrescens* (or *S. hagmanni*), as described by Lühe (1895), v. Janicki (1906), and Baer (1927).

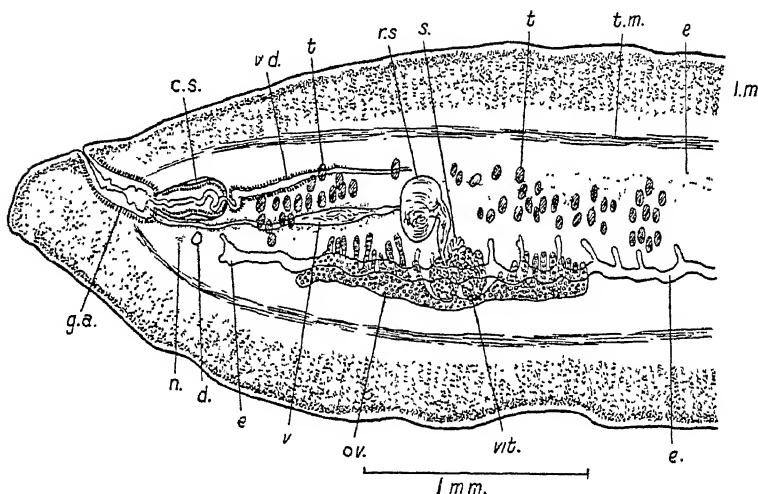
Schizotænia hydrochæri, sp. n.

External Features.—The length of an entire specimen is about 65 mm. (in alcohol, after preservation in formalin). The segments are all very short in proportion to their width, and the width of the strobila increases gradually from the scolex to somewhat behind the middle, where it attains a maximum of about 16 mm. From this point the width of the segments rather rapidly decreases again.

The scolex is relatively small, having a diameter of about 0.6 mm. The rounded suckers measure 0.25 mm. in diameter. Segmentation begins almost immediately behind the scolex. The genital pores alternate with complete regularity.

Internal Anatomy.—Musculature. Both longitudinal and transverse muscles (fig. 1, *l.m.*, *t.m.*) are very powerfully developed. The former are not divisible into outer and inner layers, but extend inwards as a thick coat of irregularly

Fig. 1.



Schizotenia hydrochoeri, sp. n. Semidiagrammatic transverse section through one half of a young mature segment (reconstructed from serial sections).

c.s., cirrus-sac; *d.*, dorsal excretory canal; *e.*, *e.*, portions of ventral excretory canal-system; *g.a.*, genital atrium; *l.m.*, longitudinal muscles; *n.*, nerve; *ov.*, ovary; *r.s.*, receptaculum seminis; *s.*, shell-gland; *t.*, *t.*, testes; *t.m.*, transverse muscles; *v.*, vagina; *v.d.*, vas deferens; *vit.*, vitelline gland.

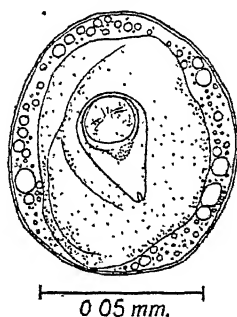
arranged bundles from the subcuticular layer to a depth equal to about three-quarters of the thickness of the cortical parenchyme. There are also thin layers of transverse and longitudinal subcuticular muscle-fibres.

Excretory System.—The "dorsal" pair of longitudinal canals is well-developed and lies laterally to the main ventral canals. The latter are connected by transverse canals, which

give rise to a system of branching and anastomosing vessels in each segment (fig. 1, *e.*, *e.*).

Genital Organs.—The whole of the genital organs, with the exception of the uterus, is confined to the poral half of the segment. (This is in marked contrast to *S. decrescens*, in which, according to Lühe, the ovary is median in the younger segments, and only slightly displaced towards the pore side in older segments, while the testes extend from the excretory canals of one side to those of the other.) The genital ducts pass dorsally to both longitudinal excretory canals and to the nerve of the pore side, which lies just laterally to the dorsal canal. They open into a common muscular genital atrium, which attains a depth of 0.5–0.8 mm. and opens somewhat to the dorsal side of the border of

Fig. 2.



Schizotænia hydrochæri, sp. n. Egg from gravid segment.

the segment. The wall of this atrium is covered externally with deeply-staining glandular cells. The cirrus-sac is pyriform, measuring, when fully developed, about 0.5–0.75 mm. in length and 0.2–0.32 mm. in width at its widest part, which is near the inner end. It is provided with a powerful muscular coat, especially towards the inner end, which contains, in segments in which the male organs are functional, a large, globular, internal seminal vesicle. The cirrus is thickly covered with spines. The vas deferens becomes a wide duct before entering the cirrus-sac, and its walls are covered externally, in this region, with glandular cells which stain deeply with hæmatoxylin. There are about 170–190 testes in each segment. These do not extend beyond the middle line of the segment, but are somewhat more

numerous on the inner than on the outer side of the female glands.

A vagina is present only in quite young segments (within about 1 cm. of the anterior end of the strobila), such as that of which a transverse section is figured. Here it opens into the genital atrium in front of the cirrus-sac (as is usual in the genus), and runs inwards, dilating considerably, to the large globular receptaculum seminis. Soon after the first appearance of the rudiment of the uterus, and before the full development of the testes and other male organs, all traces of the vagina seem to disappear. It seems, therefore, that the female organs reach maturity earlier than the male organs, and that the young segments must be fertilized by the older segments.

The ovary lies ventrally to the other organs and is transversely elongated, giving off dorsally from its two lateral portions a number of finger-like lobes.

The vitelline gland is more compact, though more or less clearly divided into two lateral portions and somewhat lobate. The uterus, as in *S. decrescens* and other members of the genus, forms at first an irregular network. Later it becomes sac-like, and occupies the whole width of the medullary parenchyme. The outer envelope of the eggs has an average diameter of 0.075 mm. The embryophore is a "pyriform apparatus" whose process apparently terminates in two short points, but lacks the long filaments figured by v. Janicki for *S. hagmanni*. The diameter of the embryophore, exclusive of the process, is about 0.022 mm., while that of the contained onchosphere is about 0.017 mm.

Comparison with Related Species.

Schizotænia hydrochæri closely resembles *S. decrescens* (*S. hagmanni*) in its general anatomy, but differs from it, as has been pointed out, notably in the fact that the male and female genital glands are situated entirely on the pore side of the middle line of the segment. General measurements are probably unreliable, owing to the great changes possible in different states of contraction. The much greater maximum width attained by the segments in *S. hydrochæri* (16 mm., as opposed to 6.5 mm. in *S. decrescens*) may, however, be a character of some importance. The dimensions of the scolex and suckers are probably more reliable. In *S. decrescens*, according to Lühe, the scolex measures 1.1×1.3 mm., and the suckers 0.75×0.55 mm. in diameter, while v. Janicki

gives the diameter of the scolex in *S. hagmanni* as 1.9 mm. These measurements are from two to three times as great as those found in the present species. The genital pores, according to the descriptions of *S. decrescens* and *S. hagmanni*, are less regular in their alternation than in *S. hydrochæri*.

The "pyriform apparatus" of the eggs appears to be somewhat larger in *S. hydrochæri* than in *S. decrescens*, and is without the long terminal filaments of *S. hagmanni*.

There is some conflict between the dimensions of the cirrus-sac as given by the different authors. Lühe gives "7.5 × 3.3 mm." for that of *S. decrescens*. There is here, presumably, an error in the position of the decimal point, and the figures should read "0.75 × 0.33." v. Janicki gives the length of the organ in *S. hagmanni* as 0.629 mm., while Baer gives its dimensions for the combined species as 0.63–0.67 × 0.2–0.23 mm. In *S. hydrochæri*, as has been mentioned above, the male organs develop late, and the cirrus-sac only reaches its full dimensions in relatively old mature segments. It would therefore be unsafe to place any reliance on measurements of this organ in different material unless it could be established that these were taken from segments of corresponding age and maturity.

The branching system of vessels arising from the transverse ventral excretory canals does not seem to have been observed in *S. decrescens* or *S. hagmanni*, though it is a feature of certain other species of *Schizotænia*.

The number of testes per segment is larger in *S. hydrochæri* (170–190) than in *S. hagmanni* (120–140) or in any other member of the genus. Of these other species (see Baer, 1927, table, p. 119), *S. americana* (Stiles, 1895), from *Erethizon* spp. in North America, seems to come nearest in general dimensions to *S. hydrochæri*, but this form is said to have only about seventy testes, and these extend right across the segment, while the ovary is median.

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LXXII.—*Some further Parasitic Worms from Sarawak.*

By H. A. BAYLIS, M.A., D.Sc.

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IN a previous paper (1926) the writer gave some account of a collection of parasitic worms made by Dr. E. Mjöberg in Sarawak. The following notes deal with a further small collection received from Dr. Mjöberg after the report on the first was in press.

The type-material of the new species described will be deposited in the British Museum (Natural History) and in the Sarawak Museum, Kuching.

NEMATODA.

Family Oxyuridæ.

Enterobius nycticebi, sp. n. (Fig. 1.)Host. *Nycticebus borneanus*.

Position. Cæcum.

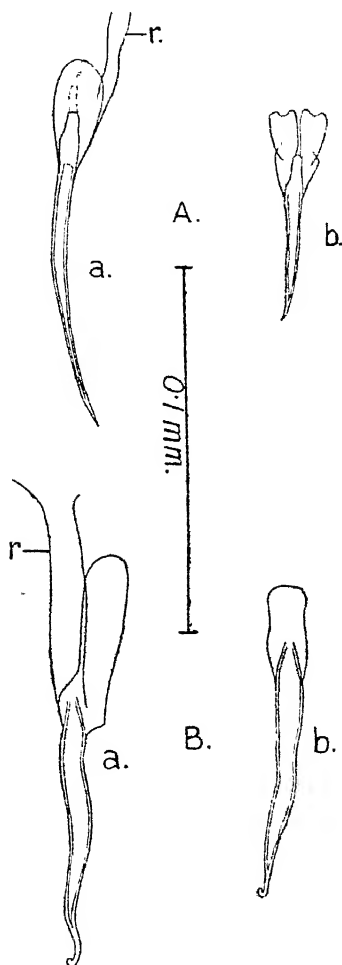
Locality. Mt. Poi.

This species closely resembles, in general appearance, the common form (*E. vermicularis*) found in man, but is considerably smaller.

The male measures 2.2–2.4 mm. in length and 0.22–0.25 mm. in thickness; the female 4.5–6 mm. and 0.4 mm. respectively. The cuticular striations are finer anteriorly than posteriorly, being about 0.0025–0.005 mm. apart in the male, and 0.005–0.01 mm. in the female. The œsophagus (including the bulb) is 0.4–0.45 mm. long in the male and 0.6–0.65 mm. in the female. The nerve-ring is situated at about 0.12 mm. from the anterior end in the male and 0.17 mm. in the female, the excretory pore at about 0.7 mm. in the male and 0.95–1.05 mm. in the female. The dimensions of the œsophageal bulb are: length 0.12–0.14 mm. in the male, 0.16–0.17 mm. in the female; width 0.1–0.12 mm. in the male, 0.14–0.15 mm. in the female. The anterior portion of the œsophagus is gradually swollen behind, then diminishes very suddenly to form a very narrow “neck” before joining the bulb.

The tail of the male is rounded and very short (0.03–0.047 mm., including a minute tail-spike measuring up to 0.01 mm. in length). The spicule (fig. 1, A) is slender and tapers to a very fine point, without the terminal hook characteristic of *E. vermicularis*. It measures about 0.1 mm. in

Fig. 1.



A. Right lateral (*a*) and ventral (*b*) views of the spicule of *Enterobius nycticebi*, sp. n. (The ventral view is greatly foreshortened, especially towards the tip of the spicule.)

B. Left lateral (*a*) and ventral (*b*) views of the spicule of *E. vermicularis*, for comparison.

r., retractor muscle.

length, and consists of a solid basal portion, of curious bifid shape when seen in dorso-ventral view, and a darker tubular portion*. The tubular portion alone measures 0.088 mm. in length. The caudal papillæ are apparently similar in number and arrangement to those of *E. bipapillatus* (Geddoelst, 1916), as described by the present writer (1923, p. 15)—i. e., there are four pairs of postanal papillæ and one large preanal pair. The fifth postanal pair figured by Lane and Low (1923, fig. 644 B, p. 1885) in a lateral position in *E. vermicularis* (the presence of which in that species the writer has verified) has not been made out in *E. nycticebi*, but may be present, as the papillæ have only been seen with considerable difficulty.

The tail of the female is long and tapering, measuring 1.1–1.3 mm. The vulva is situated at 1.5–1.75 mm. from the anterior end of the body, thus dividing the total length in about the proportion of 1:3. The average dimensions of the eggs are 0.0875×0.0375 mm.

This species is very similar to *E. bipapillatus* (Geddoelst, 1916), but differs from it in having a much shorter œsophagus and in the position of the vulva, which in *E. bipapillatus* divides the body in the proportion of 1:2. Also the eggs of *E. nycticebi* are considerably larger, and the spicule of the male is longer. There is apparently no tail-spike in the male of *E. bipapillatus*. *E. nycticebi* also very closely resembles the form described under the name of *Trypanoxyuris trypanuris* by Vevers in 1923, the male of which possesses a tail-spike. It differs, however, from *T. trypanuris* in the same respects as from *E. bipapillatus*.

Family Spiruridæ.

Rictularia mjobergi, sp. n. (Figs. 2 & 3.)

Host. *Arctictis binturong*.

Position. Intestine (also, according to collector's label,

* These two portions of the spicule are apparently present in other species, and there is some uncertainty as to whether the measurements given in descriptions include both, or only the tubular portion. Most of the existing descriptions of *E. vermicularis* give the length of the spicule as about 0.07 mm. This, according to the writer's observations, must refer only to the tubular portion. The length of the entire spicule in *E. vermicularis*, including the solid base (which, in this case, does not appear to be bifid), is 0.125–0.13 mm., and that of the tubular portion alone 0.076–0.08 mm. The solid portion seems to have been confused with the retractor muscle by some authors (e. g., in the figure given by Lane and Low (1923, fig. 644 B, p. 1885)), but is, as fig. 1 B shows, and as may be seen readily in favourable specimens, quite distinct from it.

mesentery and abdominal cavity—the worms having probably reached the body-cavity after the host's death).

Locality. Mt. Penrissen.

Of this fine species the collection includes a considerable number of specimens, which unfortunately are all females. In the genus *Rictularia* the males are commonly much smaller than the females, and may therefore easily be overlooked in collecting. The size of the present specimens varies greatly, owing to differences of age. The largest specimens are larger than any *Rictularia* hitherto recorded. The following are the more important measurements (in millimetres) :—

Length	about 25–60, or slightly more.
Thickness (maximum).....	0.9–1.6
Length of tail	0.45–0.55
Distance from anterior end to end of œsophagus	about 4.5–6.0
Distance from anterior end to end of first division of œsophagus	0.65–0.85
Distance from anterior end to cervical papillæ	0.7–1.0
Distance from anterior end to nerve- ring	0.45–0.6
Ova	about 0.047×0.032

The anterior end of the body is generally curved towards the ventral side, although the mouth opens on the dorsal surface. There are three pairs of cephalic papillæ, the subventral pair being situated near the anterior border of the mouth and the subdorsal pair on its posterior border. The lateral papillæ are double. The transversely elongated aperture of the mouth is sparsely bordered with small, blunt teeth. From the dorsal wall of the buccal capsule there projects into the cavity a structure which in lateral view (fig. 3) has the appearance of a tooth, but in dorsal view this is seen to be rather a transverse ridge, rising to an obtuse angle in the centre. The vulva is situated at a distance of 1–1.4 mm. behind the posterior end of the œsophagus. The tail is bluntly conical and has a minute terminal spike. Two subventral series of euticular “combs” and spines are present on the body, as usual in the genus. Each series contains altogether 94–97 of these structures. Of the “combs” 47–49 are situated in front of the vulva. The transition from “combs” to spines behind the vulva is very gradual*. At about the fiftieth “comb” a fairly well-marked but gradual

* In the writer's view, too much stress has been laid, in many of the descriptions of species of *Rictularia*, upon the distinction between these two kinds of structures. The so-called “combs” are really nothing more than spines flattened and expanded at the base.

increase in length begins, and from this point backwards the structures become gradually more spine-like and more widely separated, decreasing again in size posteriorly. The series

Fig. 2.

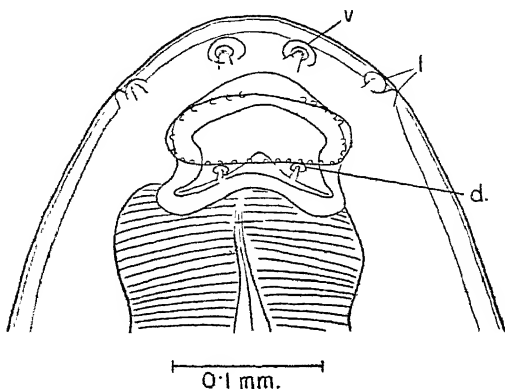
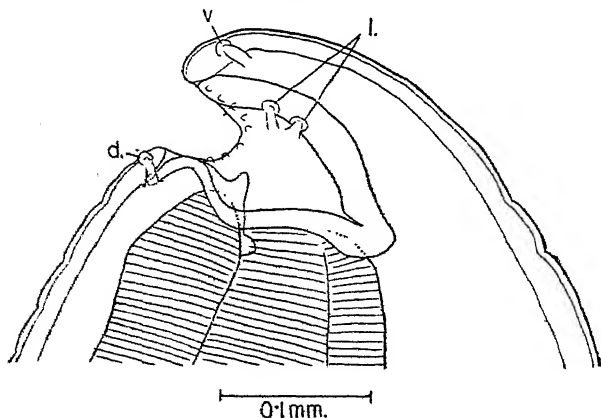


Fig. 3.



Rictularia nyöbergi, sp. n.

Fig. 2.—Anterior end of female, dorsal view. *d.*, subdorsal papilla; *l.*, lateral (double) papilla; *v.*, subventral papilla.

Fig. 3.—Ditto, lateral view. Lettering as in fig. 2.

ceases at some considerable distance from the posterior end of the body. The eggs are of a roundish-oval shape and contain embryos when laid.

Careful comparison of this species with the existing descriptions of others shows that it approaches more closely to some of those described from rodents than to those found in carnivores. In size the nearest approach to it is made by *R. elviræ*, Parona, 1889, which attains a length of 47 mm. Of this form, which is recorded from a squirrel in Tenasserim, unfortunately the description is not altogether satisfactory for purposes of comparison. *R. fallax*, Jägerskiöld, 1909, found in *Sciurus melanogaster* in Mentawai, bears a close resemblance, except in certain important measurements, to the present species. It has 42 prevulvar "combs" and 42 or more postvulvar combs and spines in each series, while *R. mjöbergi* has 47-49 prevulvar combs and about 46 postvulvar combs and spines.

CESTODA.

Family Diphyllbothriidæ.

Duthiersia fimbriata (Dies., 1854).

Some specimens obtained from the large intestine of *Varanus* sp. at Lundu were referred at the time of examination to *D. expansa*, Perrier, 1873, on the ground of the agreement of the scolex with that of *D. expansa*, as defined by Beddard (1917). Baer (1927), however, after examining a large amount of material, finds that there is great variation in the form of the scolex and in the visibility of the posterior pores of the bothria, and concludes that only a single species of *Duthiersia* occurs in monitors, whatever their geographical distribution. The earlier name, *fimbriata*, is therefore retained for this species.

Family Proteocephalidæ.

Proteocephalus shipleyi (v. Linst., 1903).

Acanthotænia shipleyi, v. Linstow (1903), p. 534.

Several specimens of an "*Acanthotænia*" occurred, together with the *Duthiersia* already mentioned, in the large intestine of *Varanus* sp. at Lundu. These are provisionally referred to v. Linstow's species, which was described from a single immature specimen from *Varanus salvator* in Ceylon.

The greatest length attained by the present specimens (when mounted in balsam) is about 22 mm., and the maximum

width about 0.5 mm. The scolex has a length of 0.2–0.28 mm. and a maximum width of 0.17–0.24 mm. The anterior portion of the scolex is not so conical as in the specimen figured by v. Linstow, but rather ovoid or acorn-shaped. The cuticular spines extend backwards over the strobila for a much greater distance than the 1.76 mm. mentioned by v. Linstow. They can, in fact, be detected throughout almost the entire strobila. The posterior (gravid) segments attain a length of somewhat over 2 mm.

The number of testes in a mature segment appears to be from 30 to 40*. They are distributed evenly across the segment, as indicated by v. Linstow's figure, and not arranged in two lateral folds as in some species†. The vagina is not always in front of the cirrus-sac, but varies in position, being equally often behind it. The cirrus is powerful and densely covered with spines. The ovary, in fully mature segments, is of much greater extent than is indicated by v. Linstow. The uterus is of the usual type, with numerous lateral pockets.

Baer (1927) has suggested that *Proteocephalus woodlandi*, Moghe, 1926, from *Varanus bengalensis*, will prove to be synonymous with *P. shipleyi*. This seems very questionable, in view of the apparently much larger size of *P. woodlandi* and the fact that it has 90–130 testes in each segment.

The tendency of recent authors (Woodland, 1925; Baer, 1927) is to regard the genus *Acanthotænia* as untenable, and the supposed generic characters as representing merely specific differences within the genus *Proteocephalus* (= *Ichthyotænia*).

Family Davaineidæ.

Houttuynia sphecotheridis (Johnston, 1914).

Davainea sphecotheridis, Johnston (1914), p. 106, pl. vi. figs. 5–7.

Specimens probably referable to this species were obtained from four species of birds belonging to four genera and three families, viz. :—

Chotorhea chrysopsis (Capitonidæ). Loc. Mt. Penrissen.

* v. Linstow gives the number as about 50, but his figure shows 37.

† In *A. birói* (v. Rátz, 1900) there are, according to Rudin (1917), 42 testes, evenly distributed. This appears to suggest a close similarity between the species, but in the descriptions by v. Rátz (1900, 1901) it is distinctly stated that the testes are arranged in two irregular groups in the neighbourhood of the longitudinal excretory canals, and their number is not given.

- * *Cyanops pulcherrima* (Capitonidæ). Loc. Mt. Murdu.
Chrysophlegma humei (Picidæ). Loc. Mt. Penrissen.
Buchanga stigmatops (Dicruridæ). Loc. Mt. Penrissen.

Johnston's species was originally obtained from *Sphecotheres maxillaris*, a bird belonging to yet another family (the Oriolidæ), in Queensland.

A striking character of *D. sphecotheridis* is the fact that the cuticle of the scolex is (to quote Johnston's description) "ornamented with numerous very delicate spines, which are stronger and more thorn-like around the base of the rostellum." Now this is the chief character by which the genus *Houttuynia*, Fuhrmann, 1920, is separated from other genera of Davaineidæ. Meggitt (1924) has emended Fuhrmann's original diagnosis of *Houttuynia*, and has referred to the genus the following species:—

1. *Tænia struthionis* of Parona, 1885 (genotype) †.
2. *Davainea linstowi*, Meggitt, 1921 (= *Tænia struthionis* of v. Linstow, 1893, renamed).
3. *Davainea beddardi*, Meggitt, 1921.
4. *Tænia frontina*, Dujardin, 1845.
5. *Houttuynia torquata*, Meggitt, 1924.

The present material shows that the appearance of a swollen, cushion-like, spiny collar round the base of the rostellum (described by Meggitt in *D. beddardi* as "in shape like a pneumatic tyre") is not constant. It is present in specimens in which the rostellum is partially evaginated, but in those in which the rostellum is completely retracted within the scolex the spiny area forms the lining of the sac within which it lies. In specimens in the latter condition the spines are not easily detected, and are liable to be overlooked altogether, in which case the species would probably be referred to the subgenus *Paroniella* of the genus *Raillietina*, Fuhrmann, 1920. Indeed, it seems somewhat doubtful whether *Houttuynia* deserves to be given generic rank, since, apart from the presence of this spiny area on the scolex, the characters of all the species would permit of their being referred to *Raillietina*, some falling into the subgenus

* These are the specimens referred to in the previous report as an undetermined species of *Raillietina*. On re-examination and comparison with the new material, they appear to belong to the same species.

† According to the rule of priority, this species should, apparently, be called *struthiocanali*, Rudolphi, 1810. It was renamed *struthionis* by Rudolphi in 1819.

Paroniella and others into *Raillietina* (sensu Stiles and Orleman, 1926 = *Ransomia*, Fuhrmann, 1920).

For convenience, however, it may be desirable to retain *Houttuynia* either as a genus or, perhaps, as a subgenus of *Raillietina*. Assuming that the group is to be thus recognized, there appear to be at least three more species, besides those mentioned by Meggitt, in which the same peculiarity occurs, and which may therefore be referred to *Houttuynia*. These are *Davainea rhynchota*, Ransom, 1909, *D. comitata*, Ransom, 1909, and the present form, *D. sphecotheridis*, Johnston, 1914.

Family Dilepididæ.

Anonchotænia aryncha, Fuhrmann, 1918.

Fuhrmann (1918), p. 429, pl. xiii. fig. 9, and text-figs. 36-42.

This species was originally recorded from *Zosterops lateralis griseonota* from New Caledonia. Some specimens, mostly fragmentary, in the present collection are probably referable to it. They were obtained from a closely related bird—*Chlorocharis emiliae*—at Mt. Poi.

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LXXIII.—*New Satyrid Butterflies.*

By H. T. G. WATKINS.

PARATISIPHONE, gen. nov.

Agrees generally with the Australian genus *Tisiphone**, Hb. (type, *abeona*, Don.), but differs in the following points:—Antennæ with a short broad club, broader than in *Xenica*; fore wing with middle discocellular straight, not curved, upper discocellular at an obtuse angle with it, slanting *inwards* (instead of outwards) to form the upper corner of cell; hind wing with cell narrower. Eyes smooth, as in *Tisiphone*. Palpi densely hairy in front.

Type and sole species, *lyrnessa*, Hew.

Hewitson described this apparently very scarce, or overlooked, New Caledonian butterfly, which has not found a place in 'Seitz,' as *Lasiommata lyrnessa* in Ent. Mo. Mag. ix. p. 85 (Sept. 1872). The type, a ♂, remained for nearly 50 years unique in the B.M. Coll.; but in 1918 a second ♂ was obtained from Mr. P. D. Montagu. The two specimens agree well together, and may be described as wholly dark fuscous above, without markings, except a minute complete eye-spot, faintly paler ringed, in 2 of hind wing. Underside of fore wing dark fuscous, paler on dorsum and termen; a white costal bar at $\frac{2}{3}$, followed by a fairly large black, white-pupilled, paler-ringed eye-spot in 5, and ending beneath in a large irregular post-median tawny patch, which is divided by the veins and ends a little

* *Enodia*, Btlr., in 'Seitz,' ix. p. 305, but this is a genus of Hubner with type *portlandia*.

below vein 2: of hind wing fuscous with slight rufous tint and sprinkled with grey, a narrow regular whitish bar from costa near apex to tornus, preceded by similar eye-spots in 2, 5, and 6, that in 2 being fairly large and ringed with pale followed by dark, and that in 5 the smallest; a zig-zag fuscous line precedes the spots, and there are traces of another nearer the base. Antennæ fuscous ringed with grey, tawny beneath towards apex, the club broad, black, with a tawny tip. Palpi fuscous, with white lateral stripe. Thorax, abdomen, and legs dark fuscous.

Exp. 48-52 mm.

I am indebted to Dr. Karl Jordan for very kindly examining the insect, and indicating what he regards as the important features of its structure.

Lethe consobrina, sp. n.

♂. Nearest to *hecate*, Leech, from Washan (Szechuan), and *cyrene*, Leech, from Changyang (Hupeh), in colour intermediate between the dark fuscous of the former and light fuscous of the latter (under which Oberthür had placed it), the wings more pointed, the blind black subterminal spots of hind wing similar but less distinct, the apical spot usually indistinct or absent, that in 4 small, that in 1c and sometimes that in 2 faintly white-pupilled. Underside differs markedly from that of *cyrene*, as figured by Leech in Butt. China, pl. vi. fig. 6, and (less clearly) by Seitz, i. pl. xxx. fig. C 6, both wings being brownish fuscous without any ochreous tint, subterminal eye-spots of fore wing in 4 to 6 only, hind wing with the median band wider, not so much darkened posteriorly, the row of eye-spots smaller and standing in a violaceous shade. Androconia similar, but more extensive both in cellule 3 and towards termen.

Exp. 62-68 mm.

W. Szechuan (Tatsienlu, Siao-lu, E. frontier of Thibet); ♂ 17 in British Museum (ex Oberthür Coll.). A single ♂ from Tseku (Yunnan) is considerably smaller (56 mm.), the androconia extend into the cell of fore wing, and the inner edge of the median band of hind wing beneath curves towards the centre of dorsum instead of running straight to join the outer edge in 1c before tornus.

Antirrhæa porphyrosticta, sp. n.

♂. Nearest to *geryon*, Feld., but much darker, nearly black. Differs in the more acuminate apex of fore wing and

longer tail in 4 of hind wing. The black eye-spots in 2, 3, 5, and 6 of both wings replaced by violet patches, those of fore wing containing a white spot on their inner side, and those of hind wing a white central dot; no trace of fulvous rings or of a spot in 3 of hind wing. Underside as in *geryon*, but rather greyer, light fuscous striated with dark, and having a faint green tint, the white darker-ringed spots (answering to the patches above) smaller and less distinct, that in 2 of hind wing showing only as a blackish ring, the dark central band not bordered with white as in *g. geryonides* from the same place.

Exp. 96 mm.

Ecuador, Ambato (*Anda Vasconez*); 1 ♂ in B.M. (ex Oberthür Coll.).

Eneis bore hanburyi, subsp. n.

Differs from ♂ 28 ♀ 23 of *b. taygete*, Hb., in the British Museum, from Labrador, as follows:—

Both sexes smaller, beneath with apex and fringes of fore wing and whole of hind wing less chequered and sprinkled with dark; central band of hind wing more regular and sharply defined on the pale area resulting from the comparative absence of the dark striation, in this resembling *b. ammon*, Elwes, from the Altai Mts.

As with all Arctic forms, the specimens of this race vary *inter se*, but the above characters may be taken as common to the series.

Described from specimens taken by Mr. David Hanbury, in 1902, on the Canadian Arctic coast about Coronation Gulf as follows:—♂ 2, ♀ 1, Grays Bay, July 1–3 (types); ♂ 1, W. of Port Epworth, July 11; ♂ 2, ♀ 3, Barren Ground, 114° W., 67° 40' N., July 13–14. The British Museum has also a pair taken at the same latitude by Sir John Richardson and presented by him in 1851; and a ♂ taken by Capt. Collinson of H.M.S. 'Enterprise,' at Cambridge Bay, Victoria I., presented in 1855.

It may be added that *assimilis*, Butler, of which the type from Repulse Bay, in Melville Pen., is in the British Museum, is not, as given by Messrs. Barnes and Benjamin in their most recent check-list, a race of *polixenes* (*crumbis*), but of *melissa* (*semidea*).

Paralasa herse dejeani, subsp. n.

♂. Wings longer than in typical *herse*, Gr.-Gr., from Amdo, N.E. Thibet; the reddish tawny patch of fore wing

with eye-spots in interspaces 2 and 3, as well as the double one in 4, 5; hind wing with an obscure eye-spot in 2. Underside of fore wing with eye-spots as above, sometimes faintly fulvous-ringed, costa near apex more spotted than in type: of hind wing less uniform dark fuscous, the darker central band well defined and followed by traces of a pale edging.

♀ (Leech, Butt. China, pl. ix. fig. 7). Paler than ♂ above and below; eye-spots larger; the reddish tawny area of fore wing not extending so far towards the base as in *h. herse* ♀ ('Seitz,' i. pl. xxxvii. fig. H 1).

Exp. 54–60 mm. (*h. herse* 46–54 mm.).

W. Szechuan (Tatsienlu, Siaolu, Houkow), described from ♂ 5, ♀ 1, in the British Museum, taken by Père Déjean for Oberthür, and ♂ ♀ taken by Pratt for Leech. The latter's Tatsienlu ♀ (his fig. 7) was taken at 8300 feet in May–June; his Houkow ♂ (fig. 8), which is not normal *dejeani*, but intermediate, at 10,000 feet, in July–August. It is probable that this butterfly has normally a single brood towards the end of May or beginning of June, Grum's series of ♂ 5, ♀ 5, *h. herse* from Amdo, being all dated between May 17 and 29, probably Old Style. Besides ♂ 6 from Tatsienlu, the Stötzner Expedition of 1914–16 record ♂ 2, ♀ 3 from Sumpanting in N. Szechuan ('Iris,' xxxix. p. 55); it would be interesting to know if these also were intermediate.

LXXIV.—*New Helicoid Snails from the Mohave Desert.*—III.

By S. STILLMAN BERRY, Redlands, California.

THE snails which are made the subject of the present communication were collected by Mr. Edmund C. Jaeger, of Riverside Junior College, in the region of the Eagle Mountains, one of the low rocky desert ranges to the south-west of Pinto Basin, on the southern confines of the Mohave Desert. Malacologically it is a wholly new region. *Micrarionta rixfordi*, Pilsbry, 1919, the only mollusk hitherto reported from this entire section of the Mohave, was found considerably to the north-westward. Mr. Jaeger was likewise fortunate enough to collect a few specimens of this species, hitherto known only from the dead shells constituting Dr. Rixford's original material, at (or, at any rate, not so very far from) the type-locality. One of the specimens was living when captured.

Micrarionta (Eremarionta) ætotis, sp. n. (Figs. 1 & 2.)

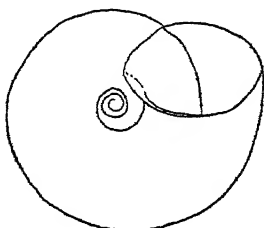
Description.—Shell of moderate size and thickness, although appreciably smaller than the following species; low-conic in outline; whorls 5 or a fraction more, convex, quite regularly enlarging, the suture distinct; last whorl moderately to strongly descending parietally. Aperture rounded, moderately to quite strongly oblique, its deflection perhaps 45° to 50° . Peristome but little thickened and scarcely at all expanded save for a slight reflection at the umbilicus, the circular outline of the latter being but little affected thereby. Umbilicus wide and funicular, though considerably narrower and steeper-walled than in the following species, its diameter being contained usually about 6 to $6\frac{1}{2}$ times in that of the shell.

Spiral sculpture wanting; embryonic shell at first smooth to weakly concentrically wrinkled, but after the initial stage

Fig. 1.



Fig. 2.



Micrarionta (Eremarionta) ætotis, sp. n., type-specimen.

afforded by the first fractional whorl the exposed surface becomes heavily covered with crowded, irregularly elongate, mostly confluent, and often anastomosing papillæ, with only traces of the usual arrangement in slanting lines, and so resulting in a peculiar scaly or semiretiform effect, quite unlike the beautiful geometric papillation seen in *M. wolcottiana* (Bartsch) and other species inhabiting the south side of the neighbouring Colorado Desert. After the first turn and a half the papillæ become lower and more irregular for a quarter of a turn more, then are rather suddenly reduced to a system of minute, individualistic, rather distant, often indistinct or nearly obsolete, rounded granules, which finally disappear altogether on the penultimate whorl.

Periostracum in living specimens, as indicated by the fresher shells in hand, a light yellowish-brown, with a

brown superperipheral band about 1 mm. wide, having a narrow and dim pale area above and below; lustre porcelainous, as in related species of the group.

Measurements.—Caliper-measurements of seven mature shells are as follows:—

	Maximum diameter.	Minimum diameter.	Altitude.	Diameter of umbilicus.	Number of whorls.
	mm.	mm.	mm.	mm.	
Type . . .	16.2	14.1	9.3	2.5	5 $\frac{1}{4}$
Paratype..	15.5	13.3	8.0	2.5	5 $\frac{1}{4}$
Paratype..	15.2	13.2	9.0	2.3	5
Paratype..	15.0	13.0	8.2	2.5	5
Paratype..	14.6	12.4	7.7	2.5	5
Paratype..	14.5	12.4	8.2	2.4	4 $\frac{3}{4}$
Palm Cn..	15.2	12.8	8.5	2.7	5

Type.—Cat. No. 6442 of the author's collection. Paratypes No. 6443 of the same collection; others to be deposited in the collections of Mr. Allyn G. Smith and the Academy of Natural Sciences of Philadelphia.

Type-locality.—North-west promontory of Eagle Mts., Riverside County, California; 11 mature and 17 immature shells, all dead, mostly well bleached and in part fragmentary, taken among granitic rocks on the slope of the mountain; Edmund C. Jaeger coll., Nov. 26th, 1927.

Additional locality.—Near the forks, west side of Palm Canyon, Eagle Mountains; 1 mature and 4 immature dead shells; Edmund C. Jaeger coll., Dec. 23rd, 1927.

Remarks.—This is a relatively high-spined and compactly coiled species, somewhat recalling *M. rixfordi*, Pilsbry, but differing in respect to the characters noted, and amply distinct as species go among the *Eremariontae*. Although smaller in every way, the shells, nevertheless, average nearly half a whorl more than the species next to be described. All three species possess the same peculiar type of sculpture on the early whorls.

Mr. Jaeger found dead shells obtainable in fair numbers, but some two hours' persistent search on the part of himself and his companions failed to reveal any living ones. The locality would be worth revisiting, perhaps, at another time of day or a different season of the year.

The shells from Palm Canyon, which is well across the range from the type-locality, do not seem recognizably different from those found on the northern side, save that, perhaps, the umbilicus in these examples is slightly wider. The range of variation in neither lot is very large.

The specific name chosen is derived from *ἀετός*, eagle, and the suffix *-της*, denoting habitation.

Micrarionta (Eremarionta) depressispira, sp. n.
(Figs. 3-5.)

Description.—Shell rather thin, of moderate size, strongly depressed, the spire varying from nearly plane (fig. 5) to very low conic (fig. 3); whorls 5 or a trifle less, convex, gradually and quite regularly expanding; suture well marked; last whorl strongly descending parietally. Aperture rounded, very strongly oblique, its deflection from the vertical about 50° . Peristome very slightly thickened or expanded on the lower moiety and weakly reflected at the umbilicus. Umbilicus broadly funicular and permeable to

Fig. 3.

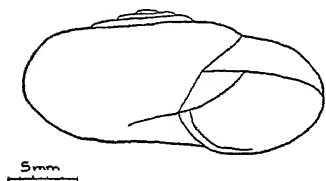


Fig. 4.

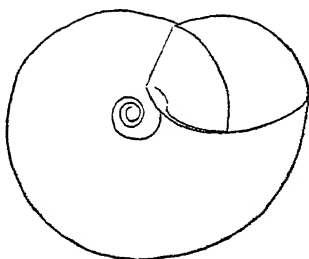
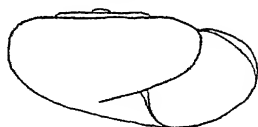


Fig. 5.



Micrarionta (Eremarionta) depressispira, sp. n.

Figs. 3 & 4.—Type-specimen.

Fig. 5.—Paratype (an immature specimen, showing extreme depression of spire).

the apex, being contained from 5 to $5\frac{1}{3}$ times in the major diameter of the shell.

Spiral sculpture wanting, the body of the shell practically smooth save for the numerous fine lines of growth. Early whorls sculptured with a heavy reticulate papillation, much as described for the preceding species, but on the later whorls the papillation is finer and more obscured by the lines of growth than there noted, soon becoming wholly obsolete.

Periostracum thin and polished in fresh specimens, the ground-colour below and to some extent above Tillenl. Ruff

deepening to Vinaceous-Buff on the spire, the shell encircled with a bright band of Bistre above the shoulder about 0.75 to 1 mm. wide.

Measurements.—Caliper-measurements of two mature specimens from the type-locality and a third from a neighbouring hill are as follows:—

	Maximum diameter.	Minimum diameter.	Altitude.	Diameter of umbilicus.	Number of whorls.
	mm.	mm.	mm.	mm.	
Type	18.2	15.4	9.2	3.2	5
Paratype..	16.1	13.5	8.2	3.0	$4\frac{3}{4}$
No. 6447..	16.5	14.2	9.2	2.7	$4\frac{3}{4}$

Type.—Cat. No. 6445 of the author's collection. Paratypes No. 6446 of the same collection.

Type-locality.—An isolated north-western outlier of the Eagle Mts., just west of road leading south from Pinto Basin, Riverside County, California; 3 mature and 6 immature shells, all dead and for the most part badly bleached, collected among granitic rocks on slope of hill; Edmund C. Jaeger coll., Nov. 25th and Dec. 26th, 1927.

Remarks.—This interesting species is one of the largest thus far brought to light of the particular group of Mohavean Eremariontas to which it belongs, and it is likewise the most nearly discoid. The size, wide umbilicus, and strongly depressed spire render its aspect markedly individual, and close comparison is necessary neither with the preceding species nor with the earlier *M. rixfordi*, Pilsbry. The sculpture of the embryonic whorls is very sharp and clean.

Although the natural cover seemed fairly good in the localities visited, Mr. Jaeger found shells exceedingly scarce and hard to find. Several hours' diligent search yielded only those mentioned, without the discovery of any living examples whatsoever. Two shells collected Dec. 27th on another isolated rocky hill, rising from the desert-floor about a mile north-west of the first locality and also on the west side of the Pinto Basin road, are very close and probably specifically identical with those obtained in the main colony, but they are sufficiently atypical, so that this cannot be asserted as definitely established. Measurements of the best example have been included in the table given.

LITERATURE.

- BAETSCH, P. 1904. "Notes on the Genus *Sonorella*, with Descriptions of new Species." Smithsonian Miscellaneous Collections, xlvii. pp. 187-200, pls. xxviii.-xxxiii. (Oct. 1904).
 PILSBRY, H. A. 1919. "A new Californian *Micrarionta*." 'Nautilus,' xxxiii. p. 53 (Oct. 1919).

LXXV.—*The Generic Name Delphax in Mammalogy.*

By OLDFIELD THOMAS.

MY attention has been drawn by Mr. F. Muir, of Honolulu, the well-known homopterist, to the generic name *Delphax*, which, dating from Fabricius, 1803, has been in use in entomology for many years, but is antedated by the Cetacean *Delphax*, Artedi, 'Genera Piscium,' ed. Walbaum, iii. p. 579 (1792), where it is published under the heading of "Nova Genera Kleinii," being one of the three genera into which the order is there divided—*Balena*, *Narwhal**, and *Delphax*.

Now, since it is quite validly put as "*Delphax*, *das Meerschwein*," Meerschwein being commonly used as the vernacular name of the porpoise, and as it long antedates the familiar name *Phocæna*† for the latter, the question arises as to whether it ought not to supersede that name on the ground of priority.

Fortunately, I am able to indicate that this is not the case, for the name *Delphax* is clearly used as the equivalent of what we should now call the Delphinidæ, and is not specially based on the porpoise. If we take Klein's work 'Historiæ Piscium,' and look at his "*Missus secundus*," 1741, from which Walbaum was quoting, we find on p. 9 a synoptical table of three genera or groups of Cetacea, of which the third—Delphaces—consists of the three species (*Delphinus*) *orca*, *delphis*, and *tursio seu phocæna*, the last-named being in no way indicated as the genotype. There being, therefore, no genotype, I now formally select *Delphinus delphis*, L., as the genotype of *Delphax*, and thus safely pack away the latter in the synonymy of the earlier name *Delphinus*, Linnæus, 1758.

It may finally be noted that the vernacular word Meerschwein is frequently used for *Delphinus delphis* as well as for *Phocæna phocæna*.

* Mr. Palmer (Gen. Mamm. p. 448, 1904, footnote) says "Narwhal, Walbaum, quoted by Sherborn, is not a valid generic name." Nor is it, as quoted by him from pp. 558 to 568 of 'Artedi,' ed. Walbaum, but from p. 579, the reference given by Sherborn, it is, like *Delphax*, perfectly valid, and Sherborn's quotation of it is entirely correct. Fortunately, it equals, and is antedated by, *Monodon*, Linnæus, 1758, and may therefore be dismissed as a synonym.

† G. Cuvier, 1817.

LXXVI.—*New Species of Lepidoptera Heterocera in the Collections of the British Museum (Natural History)*. By W. H. T. TAMs.

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THE moths described in this short paper have been gathered together from various sources, and the types, with the exception of that of *Chrysopsyche wilsoni*, which is in the Hope Department of the Oxford University Museum, are in the British Museum. I am indebted to Professor E. B. Poulton, F.R.S., for the opportunity of studying the series of *Chrysopsyche wilsoni*, and for the paratypes which he has generously presented to the British Museum. The fine Liparid, *Numenes fragrans*, was presented by the collector, Mr. R. C. Blackwood. Dr. G. A. K. Marshall, C.M.G., F.R.S., Director of the Imperial Bureau of Entomology, has kindly presented the types, and some other specimens, of *Agylla gateri*, *Nygmia corbetti*, *Mahasena corbetti*, *Streblote lipara*, and *Lamprosema camphoræ*. The remainder of the material was sent to me by the Director of the Raffles Museum, Singapore, to whom I am indebted for the types and other specimens.

Arctiidae.

LITHOSIINÆ.

Agylla gateri, sp. n.

♂. Antenna pectinate. Palpus, antennal shaft, head, and patagia light buff, the latter wood brown distally; thorax wood brown; abdomen light buff to avellaneous. Pectus, legs, and venter light buff, the legs tinged with avellaneous. Fore wing with a light buff ground, marbled with a mixture of avellaneous, wood brown, fawn coloured, and army brown scales, the areas so coloured irrorated with anthracene purple; from the base to the irregular, light buff subterminal fascia, through the cell, a glossy light buff streak, broken at the discocellulars. Hind wing light buff, shaded distally with avellaneous. Underside light buff, fore wing tinged with pinkish buff below costa, hind wing broadly warm buff along costa.

Expanse 22 mm.

♀. Similar, but with markings more contrasted. Antenna with fine short bristles.

Expanse 22 mm.

Holotype ♂ and allotype ♀ : MALAY PENINSULA, Serdang, 29. i. 1925 (*G. H. Corbett and B. A. R. Gater*). Larva feeding on *Casuarina*.

Paratypes : 2 ♀ ♀, from the same source.

Liparidæ.

Numenes flagrans, sp. n.

♀. Palpus ochraceous orange, irrorated with warm velvety fuscous black. Antenna warm velvety fuscous black, with a fine white streak on each side at base of pectinations. Head warm velvety fuscous black with some white scales posteriorly. Thorax warm velvety fuscous black, the patagia streaked with white, the tegulæ edged with ochraceous orange, and with long spreading hair-scales, mixed ochraceous orange and fuscous black, streaked with a few short white scales. Abdomen ochraceous orange, with orange-chrome suffusion. Pectus and legs ochraceous orange, with fuscous black irroration; venter ochraceous orange. Fore wing rich, warm velvety fuscous black, with a somewhat irregular, curved (concavity terminad) white fascia from apex to tornus, joined by two oblique white fasciæ, one from costa at about one-third, narrow, the second from the costa at two-thirds, broader. Hind wing orange to orange-chrome, suffused with flame scarlet distally, with a fuscous black border and fringe, the border wider and with a crenate edge (convexities basad) from apex to vein *M* 3, and terminating in a small tooth-shaped projecting mark between veins *M* 3 and *Cu* 1, pointing basad; the fringe at anal angle ochraceous orange.

Underside : fore wing with the white fasciæ less prominent, and with a longitudinal white stripe between vein *Sc* and upper margin of cell+vein *R* 1; hind wing without the fuscous black border, but with the fringe fuscous black from apex to near anal angle.

Expanse 82 mm.

Holotype ♀ : ASSAM, Ki Ker, 3. x. 1926 (*R. C. Blackwood*).

It is remarkable that such a conspicuous moth should so long have escaped the attention of collectors. A year or two ago a specimen of this species passed through my hands. It had been sent to the Bombay Natural History Society by Mrs. Williams—of the Silloah Tea Estate, Juri T.O., S. Sylhet,—by whom it was taken. The Bombay Natural History Society sent it to the Hill Museum, Witley, for identification, and it was shown to me by Mr. L. B. Prout, who tells me that it was returned to the Bombay Natural

History Society. I have heard nothing of it since. When Mr. Blackwood brought his collection to show me, and while he was unpacking it, he made the remark that he supposed that there was nothing in it of interest, as Assam must have been more or less exhaustively collected. I replied that such was by no means the case, and commenced to tell him about this very moth. When he pulled out the first drawer of a small cabinet he had been unpacking, and disclosed the specimen here described, I was no less surprised than Mr. Blackwood, and I was delighted at the readiness with which he offered me the specimen for the Museum.

Nygmia corbetti, sp. n.

♂. Palpus cinnamon buff, shaded laterally with fuscous. Antenna avellaneous. Head cinnamon buff, thorax avellaneous with some cinnamon buff in front, abdomen avellaneous lightly shaded with fuscous and with cinnamon buff terminal tuft. Pectus, legs, and venter pinkish buff. Fore wing pinkish buff, suffused with clay colour, and sparsely irrorated with warm velvety fuscous black scales, with a warm velvety fuscous black medial fascia from middle of costa to lower margin of cell between veins *Cu* 1 and *Cu* 2, thence to middle of inner margin. Hind wing pinkish buff, lightly suffused with fuscous. Underside of fore and hind wings light buff.

Expanse 30 mm.

Holotype ♂: MALAY PENINSULA, Kuala Lumpur, 14. iii. 1924 (G. H. Corbett and B. A. R. Gater). Larva feeding on *Aleurites montana*.

Lasiocampidæ.

Chrysopsyche wilsoni, sp. n.

♂. Palpus and frons warm buff; antennal pectinations proximally honey yellow to bone brown distally; antennal shaft, vertex of head, thorax, and abdomen (except ochraceous orange terminal tuft) ochraceous buff to clay colour; pectus, legs, and venter warm buff to ochraceous buff. Fore wing tawny olive to light brownish olive, lightly suffused with coral red along costa, and with hellebore red near wing-base and at termen; an ochraceous orange streak from base to a similarly coloured dash along discocellulars; an orange ochraceous streak from base to tornus between veins *Cu* 2 and *A* 2, parallel with and nearer to the former; a distinct sinuous raisin black antemedial fascia (almost fine enough to be called a line); a similar postmedial fascia,

sharply outcurved from costa (concavity apicad) to vein *M* 1, thence direct to inner margin at right-angles to cubital veins; a subterminal fascia of dark slate purple, ill-defined, wedge-shaped (points basad), interneural spots, almost parallel with termen, but running into tornus; colour of fringe hardly differing from ground-colour. Hind wing old gold, costally hellebore red; a dark slate purple medial shade extending only from costa to cell; outer margin of wing suffused with dark slate purple, more noticeably at apex; fringe light buff. Underside of both fore and hind wings dark olive buff, unevenly shaded with dark slate purple, the fore wing with the orange ochraceous streaks similar to those on the upper side, and traces of the subterminal fascia, the hind wing paler at base and with the medial shade extending to below the cell; fringes of both wings light buff.

Expanse 35 mm.

♀. Palpus, antenna, head, thorax, abdomen above and beneath, pectus, and legs ochraceous buff, the thorax and abdomen enriched with orange buff. Fore wing pale orange yellow, thickly irrorated with velvety black scales at base of cell, with a few similar scales scattered along the veins, becoming even more sparsely distributed beyond the cell; arrangement of fasciæ as in ♂, but colour orange rufous; the postmedial very distinctly crenulate (convexities basad); the subterminal commencing below vein *R* 4, gradually obsolescent tornad, its colour somewhat modified by sparse black irroration; hind wing orange buff with pale orange yellow fringe. Underside of both fore and hind wings pale orange yellow to ochraceous buff, the fore wing with the fasciæ only faintly indicated, the hind wing with a prominent orange rufous medial shade commencing as a crescent (convexity basad) from costa to vein *M* 1, thence obsolescent.

Expanse 52 mm.

Holotype ♂ and allotype ♀: SUDAN, Nuba Mountains Province, Talodi district, 8 miles east of Talodi, Tereida, 19. iv. 1918, on *Combretum ghasalense* tree (*R. S. Wilson*); in the Hope Department, Oxford University Museum.

Paratypes: 4 ♂ ♂, 4 ♀ ♀ from the same source.

Thanks are due to Professor E. B. Poulton, F.R.S., for his generous gift to the British Museum of two pairs of this interesting moth, for the opportunity of studying which I am also grateful to him.

STREBLOTE, Hübner.

Streblote, Hubner, Verz. bek. Schmett. p. 193 (1822).

Megasoma, Feisthamel, Ann. Soc. ent. France, i. p. 340 (1832) (*new* Kirby, Col., 1825).

Nadiasa, Walker, List Lep. Ins. B.M. v. p. 1014 (1855).

Taragama, Moore, Cat. Lep. East India Company, ii. p. 427 (1859) (n. n. for *Megasoma*, Feisth.).

Concœdes, Wallengren, Vet.-Akad. Handl. (2) v. (4) p. 31 (1865).

Ticera, Swinhoe, Cat. Lep. Het. Oxford Mus. i. p. 269 (1892).

This genus has long been known by the name *Taragama*, but it has now become necessary to supplant that name. I have been able to establish the fact that *Nadiasa concolor*, Walker, belongs to this genus, and as *Nadiasa* is an older name than *Taragama*, it should replace it. On the other hand, I can find no adequate reason for setting aside Hübner's name *Streblote*. *Streblote* was founded by Hübner for three species, two Lasiocampidæ and one Limacodid. Up to the present I have been unable to find any evidence that the name has been correctly utilized for a genus of Limacodidæ, and so, as it is necessary to select a name for the genus now under consideration, I have decided to use the name *Streblote*, Hübner, with genotype *S. panda*, Hübner, a new name given by him to the species he originally called *Bombyx repanda*, which name had previously been used by Fabricius in 1793. Should *Streblote* be ultimately found to be inadmissible, *Nadiasa*, Walker, will be available.

Streblote lipara, sp. n.

♂. Palpus light buff above, ochraceous orange laterally and beneath; antennal shaft ochraceous buff, pectinations honey yellow; head and thorax light to warm buff, the tegulæ carob brown; abdomen carob brown, streaked warm buff distally; pectus, legs, and venter carob brown streaked with warm buff and fuscous, abdomen warm buff distally with a carob brown to fuscous black tuft before the genital opening, legs with buff-ringed tarsi. Fore wing carob brown, basal two-thirds of a warm velvety appearance, bounded by an irregularly sinuous, oblique, cartridge buff postmedial fascia, apart from its wavy character parallel with termen, terminal third of wing densely irrorated with cartridge buff to light buff scales, some subterminal patches without irroration; the cell and a wedge-shaped area below it bounded by the inconspicuous cartridge buff antemedial

fascia, filled in with Sanford's brown to chestnut, this colour extending beyond the end of the cell for a short distance, but interrupted by a dark streak on the discocellulars; a conspicuous light buff spot at wing-base; a warm buff broad-based triangle, base on costa just beyond end of cell, apex at junction of vein *R*4 with stalk of *R*5 + *M*1; fringe light buff. Hind wing with termen almost straight, carob brown, with a cartridge buff wedge-shaped subterminal fascia, its broad end towards anal angle; before inner margin two longitudinal cartridge buff streaks from wing-base to fascia; area between fascia and termen lightly irrorated with cartridge buff scales; fringe light buff. Underside similar to upper side, without velvety appearance, and without the Sanford's brown areas in fore wing; hind wing with the two light streaks from base towards anal angle, which is fuscous black.

Expanse 52 mm.

♀. Similar to ♂, but with the following differences:—Larger, wings more ample and less richly coloured, hind wing termen deeply rounded. Fore wing with the Sanford's brown colouring much more extensive and the cartridge buff irroration covering almost the outer half of the wing. Hind wing with the fascia very broad, especially on the inner margin, which is wholly cartridge buff.

Expanse 72–82 mm.

Holotype ♂ and allotype ♀: MALAYA, Serdang, 23. iv. 1926 (*G. H. Corbett*). Apparently bred from larvæ feeding on *Casuarina equisetifolia*.

Paratypes: ♂ and 2 ♀ ♀, from the same source.

Streblote enthismena, sp. n.

♂. Palpus bone brown, streaked with liver brown, ochraceous orange beneath; antennal shaft chamois streaked with bone brown; head and thorax white streaked with liver brown and bone brown; tegulæ liver brown, abdomen bone brown with white streaking; pectus and venter bone brown streaked with white, the legs streaked and ringed with warm buff. Fore wing bone brown enriched ante-medially below cell and at end of cell with liver brown and closely irrorated or streaked with white to cartridge buff; from the end of the cell towards the tornus there is a short strip of ground-colour without irroration showing up rather prominently against the lighter irrorated area; a white spot at base and a dark spot at end of cell; an irregularly

sinuous white postmedial fascia, parallel, apart from its wavy character, with termen, but running into tornus. Hind wing bone brown, with faint white streaking, more pronounced subterminally and producing the effect of a slightly lighter subterminal third to the wing; termen not evenly curved, having a slight bulge at middle. Underside evenly bone brown, with traces of the fasciæ in the form of white to light buff irroration, both on fore and hind wings, with a marginal strip of white to light buff irroration before the termen; fore wing, in addition, light buff at base and along inner margin; fringes white to light buff, very narrow.

Expanse 51 mm.

♀. Larger, similar, but liver brown, and differing in the following features:—Spot at end of cell isolated, prominent; postmedial fascia obsolete below vein *M* 3, and nowhere so prominent as in ♂; postmedial fascia on hind wing diffuse but conspicuous; underside with postmedial fascia in fore wing complete from costa to inner margin; white irroration much more extensive than in ♂.

Expanse 90 mm.

Holotype ♂: MALAYA, Singapore, Gilstead Road, 12. xii. 1916 (*V. K. coll.*).

Allotype ♀: MALAYA, Singapore, Tanjong Pagar, xii. 1916 (*Ahmat coll.*).

Paratypes: 3 ♂ ♂, 3 ♀ ♀, from the same source as allotype ♀.

Lebeda agnata, sp. n.

♂. Palpus warm blackish brown irrorated distally with light buff. Antenna honey yellow, the shaft shaded with chocolate at base. Head and thorax in front army brown closely irrorated with light buff; posterior two-thirds of thorax hazel. Abdomen vandyke brown. Pectus, legs, and venter liver brown, the colour of the pectus and legs enriched with warm blackish brown. Fore wing rich chestnut brown, lighter in proximal third; an almost straight antemedial fascia of two army brown lines 2 mm. apart, enclosing ground-colour; a prominent, sharply-defined, white lunule on discocellulars; a somewhat oblique, sinuous postmedial fascia of two army brown lines 6 mm. apart at costa, 4 mm. at inner margin, enclosing ground-colour, rich chestnut brown above vein *M* 2, hazel below; no definite subterminal fascia, but beyond the postmedial fascia, and below vein *M* 2,

a brightly coloured burnt sienna patch, strongly dentate distally on veins *Cu* 1, *Cu* 2, and *A* 2; fringe slightly lighter than ground-colour. Hind wing chestnut brown to fuscous, with traces of a slightly bowed (concavity basad) postmedial fascia of two army brown lines 4 mm. apart; fringe edged with army brown. Underside chestnut brown, proximal half of both fore and hind wings much richer, with the discocellular mark, the two lines of the postmedial fascia, and the veins lighter; the costa of the hind wing slightly emarginate and enriched with chestnut (as distinct from the chestnut brown ground-colour—*cf.* Ridgway, pls. ii. & xiv.).

Expanse 76 mm.

Holotype ♂: NEGRI SEMBILAN, Gunong Angsi, 2000–2700 feet, April 1918.

This fine species, though smaller, has the exact facies of *Lebeda cognata*, Grünberg, but is more richly coloured.

Metanastria leucopicta, sp. n.

♂. Palpus hazel. Antenna hazel, pectinations honey yellow. Head and thorax hazel streaked with light buff, the latter shaded chestnut brown posteriorly. Abdomen wood brown, streaked chestnut brown dorsally. Pectus, legs, and venter chestnut brown irrorated with light buff. Fore wing chestnut brown to carob brown, broadly enriched with burnt sienna (dull) along costa, the subterminal area bistre to warm sepia; a small light buff spot at end of the very small cell; a deeply curved (concavity basad) fuscous black postmedial fascia, crenulate (convexities basad), apparently commencing about vein *R* 4, curving round and apparently running into inner margin at middle after slightly recurving where it crosses vein *Cu* 2; a straight, oblique, subterminal fascia from apex to inner margin at about three-quarters (though apparently two-thirds), indicated by white to pearl grey scaling, preceded by a deepening of the ground-colour, and succeeded by some light shading of (dull) burnt sienna on the warm sepia ground of the subterminal area, this burnt sienna shading again edged distally with white scales, the latter surrounding indefinite spots of chestnut brown from middle of wing to inner margin. Hind wing bistre to warm sepia, with a prominent patch of white to pearl grey scales at anal angle. Underside avellaneous to wood brown enriched postmedially and before termen with bistre, and sparsely irrorated with light buff

scales, with some pearl grey scales at anal angle of hind wing.

Expanse 69 mm.

Holotype ♂: NEGRI SEMBILAN, Gunong Angsi, 2000-2700 feet, April 1918.

Psychidæ.

Mahasena corbetti, sp. n.

♂. Head, thorax, and abdomen mummy brown, fore wing argus brown to Mars brown, hind wing fuscous to fuscous black. Underside similar, but hind wing as warmly coloured as fore wing. Legs mummy brown, with tarsi and distal hair-scales of tibiae light buff.

Expanse 25-30 mm.

Holotype ♂: MALAYA, Tapah, 22. ix. 1922 (G. H. Corbett), ex Tuba (*Deguelia*).

Paratypes: MALAYA: 2 ♂♂, Tapah, 22. ix. 1922 (G. H. Corbett); 3 ♂♂, Singapore (H. N. Ridley), before or during 1905; 9 ♂♂, Kuala Lumpur, 10, 24. vi., 27. ix. 1924, 3. iii., 7. viii. 1925, 30. xi. 1926; 13 ♂♂, Serdang, 9, 23, 29. viii. 1924, 25. iii., 16, 18. iv., 23. v. 1925; 3 ♂♂, Parit Buntar, xi. 1922; ♂, Banting, 23. ix. 1925; ♂, Bukit Tambun, 25. v. 1925; ♂, Seremban, 8. iii. 1924; ♂, Puchang, 21. viii. 1926; 2 ♂♂, Carey Is., xi. 1923. All collected by G. H. Corbett and B. A. R. Gater.

Larvæ found feeding on the following plants:—*Arenga sacchifera*, *Cupressus funebris*, *Aleurites montana*, *Asparagus plumosus*, *Citrus* sp., Areca nut (*Areca catechu*), Tuba (*Deguelia*), Coconut, African Oil-palm, West Indian Gum-tree, Kapok.

Pyalidæ.

PYRAUSTINÆ.

Lamprosema camphoræ, sp. n.

♂. Palpus proximally white, distally fuscous black. Antenna honey yellow, ciliate. Head with frons fuscous below, ochraceous orange above, vertex light buff, occiput ochraceous orange. Patagia ochraceous orange, tegulæ glossy white, fuscous and ochraceous orange anteriorly and tipped posteriorly with ochraceous orange. Thorax glossy white, with a transverse fascia level with tips of tegulæ. Abdomen with the segments ochraceous orange anteriorly, white

posteriorly. Pectus, legs, and venter glossy white; fore legs with tibiæ and tarsi banded fuscous black and ochraceous orange, middle legs lightly shaded with ochraceous orange, the tibiæ lightly infuscate. Fore wing glossy white, with considerable orange suffusion, the markings fuscous black; a bowed (concavity basad) ochraceous orange sub-basal fascia; a fuscous black streak on costa to fuscous black antemedial fascia, which is bowed, but less deeply than the sub-basal; a small fuscous black spot in middle of cell, followed by a slightly bowed (concavity basad) fuscous black postmedial fascia from costa to termen at vein *Cu* 2, there acutely angled and running back straight to the cell between veins *Cu* 1 and *Cu* 2, at the lower angle of the cell again angled and running obliquely to middle of inner margin within about 1 mm. of antemedial fascia; area between antemedial and postmedial fasciæ suffused with ochraceous orange, with some slight fuscous black suffusion between bases of veins *M* 2-*Cu* 1; costa fuscous black from just beyond end of cell to apex, termen fuscous black, the area immediately preceding it broadly ochraceous orange; fringe ochraceous orange, tipped with fuscous black and with a fuscous black line running through it; a short section of fringe near the tornus lacking the fuscous black tips to the scales, the line through it weaker. Hind wing glossy white; a fuscous black streak on the discocellulars; postmedial fascia fuscous black, from costa at two-thirds running out at middle of cell to middle of vein *M* 2, crossing *M* 3 and *Cu* 1 at right angles, running back along *Cu* 1 nearly to lower angle of cell, thence sinuously to inner margin at two-thirds; termen fuscous black, preceded by ochraceous orange suffusion; fringe ochraceous orange, tipped with fuscous black, and with a fuscous black line running through it; a short section of fringe below vein *Cu* 2 ochraceous orange, but with the fringe-line prominent. Underside pale orange yellow, paler wing-bases, fore wing costa fuscous black, termen and fringe in both fore and hind wings fuscous black, upper-side markings showing through.

Expanse 22 mm.

♀. Similar.

Holotype ♂ and allotype ♀: MALAYA, Kuala Lumpur, 15. i. 1927 (*G. H. Corbett*). Ex *Cinnamomum camphora*.

Paratypes: 3 ♂♂, 3 ♀♀, from the same source, with dates 23. vi. 1926 and 15. i. 1927.

(Colours from Ridgway's 'Color Standards and Color Nomenclature,' 1912.)

LXXVII.—*Description de nouveaux Homoptères du Muséum de Londres.* Par le Dr. V. LALLEMAND (Uccle).

(1) *Clovia rapana*, sp. n.

Tête, sternum, pattes ocre-jaune; sont noirs: une dizaine de stries transversales de chaque côté du front, le bord antérieur et une bande le long du bord postérieur du vertex, le pronotum, l'écusson, les élytres, sauf une bande le long du bord externe, l'abdomen (sauf les bords latéraux et postérieurs des segments qui sont ocre-jaune), l'extrémité des tarses et des épines; la partie latérale de l'élytre est d'abord ocre-jaune, puis devient blanche transparente, un peu en avant du tiers apical elle se rétrécit un peu, puis s'élargit assez fortement et dans cette partie dilatée se voient trois nervures brun-noir (une longitudinale et deux transversales). Ailes légèrement enfumées, plus foncées à l'extrémité.

Front bombé, à partie centrale plane, sillons transversaux peu marqués; vertex plan, triangulaire, à bord arrondi, aussi large que le pronotum et à peu près aussi long que large entre les yeux. Pronotum ponctué en stries transversales bien marquées. Ecusson plus long que large, ponctué en fines stries transversales. Elytres longs et étroits, finement ponctué, à nervures saillantes. Tibias postérieurs ayant deux épines.

Longueur, ♂ 7 mm., ♀ 85 à 9 mm.

Hab. I. Rapa ('*St. George*' Expedition, C. L. Collenette).

Trouvée sur des herbages durant le mois d'avril, 1925.

(2) *Clovia sociabilis*, sp. n.

Sont ocre-jaune: le front, le premier article du rostre, le milieu du sternum, les pattes, le milieu du vertex et du pronotum, l'écusson ainsi qu'une bande plus ou moins large le long du bord interne, comprise entre la pointe de l'écusson et celle du clavus (cette dernière peut être jaune-grisâtre); sont noirs: cinq à six lignes sur le front, le bord antérieur et les côtés du pronotum, les élytres, les côtés du sternum, les segments abdominaux (sauf leurs bords postérieurs et latéraux); le long du bord externe des élytres, une bande et une grande tache blanche, plus ou moins hyalines, sur la tache une partie des nervures est noir-brun. Ailes plus ou moins enfumées vers la partie interne et surtout apicale, hyalines vers l'extérieur.

Longueur 8 mm.

Hab. Society Is., Tahiti (March 1925); Lake Vaihira, 17. vii. 1925 (*Miss Cheesman*).

(3) *Clovia insignis*, Distant.

Deux exemplaires de l'île Tahiti différent de ceux de l'île Henderson, décrits par Distant, en ce que tout le clavus est concolore, noir (son extrémité n'étant pas ocre).

Var. *interrupta*, nov.

La bande située le long du bord externe est coupée en deux et dessine d'abord une bande longitudinale d'un blanc plus ou moins jaunâtre, puis une grande tache hyaline, dans laquelle une partie des nervures est noire; pas de tache ocre à l'extrémité du clavus.

Hab. Society Is., Bora-Bora, M. Panui, 20. vi. 1925 (*Miss Cheesman*).

Voici une table dichotomique relative aux espèces du groupe *insignis*, Distant:—

- | | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|
| 1 (a) Ecusson jaune | 2. |
| (b) Ecusson et pronotum noirs | <i>C. rapana</i> , sp. n. |
| 2 (a) Pronotum noir | <i>C. juddi</i> , Lallemand. |
| (b) Pronotum plus ou moins largement jaune ... | 3. |
| 3 (a) Tête et pronotum entièrement jaunes ... | <i>C. navigans</i> , Jacobi. |
| (b) Tête et pronotum partiellement jaunes ... | 4. |
| 4 (a) Une bande longitudinale jaune sur le pronotum, n'atteignant pas son bord antérieur | 5. |
| (b) Une bande jaune s'étendant depuis le bord antérieur du vertex jusqu'à l'extrémité de l'écusson (les côtés du vertex étant noirs) | <i>C. sociabilis</i> , sp. n. |
| 5 (a) Le long du bord externe des élytres, une large bande d'un blanc plus ou moins ocreux | <i>C. insignis</i> , Distant. |
| (b) Sur le côté externe des élytres une bordure blanche, s'étendant jusqu'un peu au-delà du milieu et ensuite une grande tache blanche, transparente | [<i>rupta</i> , nov.
<i>C. insignis</i> , var. <i>inter-</i> |

(4) *Clovio pallida*, sp. n.

Jaune-paille pâle; abdomen de coloration variable, quelquefois tout l'abdomen est brun foncé avec le bord postérieur des segments jaune, d'autrefois la face supérieure des trois derniers segments et des organes génitaux est plus ou moins brune; extrémité des tarsi et des épines noire; milieu des yeux brun-foncé avec une bordure jaune plus ou moins large. Elytres blanc-jaunâtre, avec des places plus jaunes, spécialement une bande le long de la moitié antérieure du bord externe et quelquefois sur le clavus le long de la suture. Ailes très légèrement enfumées, à nervures brunes.

Vertex grand, plan, un peu moins long que large entre les yeux, à bord antérieur arrondi en son milieu. Deux épines sur les tibia postérieurs.

Longueur totale 8 à 8.5 mm.

Longueur du corps 6.5 mm.

Elytres: longueur 6 mm., étendus 14 mm.

Hab. Tahiti, Tautira (Valley Vaitepila), Hitiaa (*Miss Cheesman*).

Recueillie en juin, juillet et août.

(5) *Clovio cheesmani*, sp. n.

Noire; sur le front, six à sept stries transversales, latérales, blanc-jaunâtre; premier article du rostre et partie frontale du

vertex gris-blanc; bordure postérieure des segments abdominaux ocre. Sont blanches les taches suivantes: une plus ou moins bien marquée sur le milieu de l'écusson, une petite vers l'extrémité du clavus et deux autres au bord externe des élytres, la première est allongée, oblique en avant et en dedans, la seconde assez grande, en demi-cercle (une partie des nervures qui s'y trouvent, sont noir-brun). Ailes enfumées.

Surface supérieure de l'insecte assez brillante, recouverte de poils roux, spécialement sur le vertex et le pronotum.

Longueur 10 mm.

Hab. Tahiti, Lake Vaihira, 19. vii. 1925 (*Miss Cheesman*).

Je dédie cette espèce à la personne qui l'a recueillie.

(6) *Clovio natalensis*, sp. n.

Gris-brunâtre clair; sur le vertex, le pronotum et l'écusson, une large bande longitudinale jaune s'étendant d'une extrémité à l'autre, de chaque côté de celle-ci, sur le vertex et le pronotum deux lignes brunes, une plus large en bordure et l'autre un peu plus externe, sur la partie postérieure du pronotum les deux lignes de chaque côté, se soudent pour former une tache brune. Élytres recouverts d'une villosité dense d'un roux clair, d'un brun très légèrement brunâtre et semi-transparents le long du bord externe et vers l'extrémité; entre le médian et le radius une bande brune, irrégulière, s'étendant de la base vers l'extrémité; à la partie apicale une seconde bande longitudinale entre les deux branches du radius; nervures brunes sur le clavus et la base du corium; à la pointe du clavus une grosse tache calleuse noire. Ailes légèrement enfumées, à nervures brunes. Front jaunâtre, sauf la partie inférieure qui est brune, de chaque côté de celui-ci, s'étendant jusqu'à l'extrémité du mésosternum, une ligne jaune; en arrière de chacune des hanches antérieures une grande tache noire; prosternum ocre-brun; méso- et métasternum, abdomen et pattes ocre, extrémité des tarses et des épines noire, tarrière brun-noir.

Voisin de *C. centralis*, Distant, s'en distingue par la coloration de la ligne centrale longitudinale et le bord antérieur du vertex un peu plus arrondi, celui-ci est un peu moins long que le pronotum; ocelles petits, légèrement plus près des yeux que l'un de l'autre; pronotum et vertex à sillon médian longitudinal beaucoup moins profond que celui de *C. centralis*.

Longueur 7 mm.

Hab. Natal, Kloof (1500 ft.), Aug. 1926 (*R. E. Turner*).

(7) *Microsargane vittata*, Fowler.

Biologia Centrali-Americana, Ins., Rhynch., Hemiptera, vol. ii. part 1, p. 196 (1897).

Microsargane ornatipennis, Lallemand, *Trans. Ent. Soc. Lond.* p. 104 (1927).

(8) *Sphenorhina insularis*.

Corps rouge; grande fossette centrale de l'écusson et face supérieure de l'abdomen rouge-brunâtre; extrémité des cuisses et tibiae

des pattes antérieures et médianes, extrémité des tibias postérieurs, tous les tarses, rostre (sauf sa base), articles basaux des antennes noirs; ocelles jaune clair. Elytres bruns, à partie apicale plus foncée, partie basale du clavus et une bande externe au tronc du radius et à sa branche interne de bifurcation rouges, cette bande s'étend jusqu'au devant de la partie apicale et est coupée au milieu de la longueur de l'élytre par une grosse tache brun-foncé, les élytres sont semi-transparents, sauf à la partie externe rouge, où ils sont opaques. Ailes enfumées, à nervures brunes et base rouge.

Front relativement assez applati transversalement, vu de côté, présente un angle obtu. Sur les élytres, médian et cubitus non soudés, réunis seulement par un rameau transverse. Deux épines sur les tibias postérieurs (une petite et une grosse).

Longueur totale 9 mm.

Longueur du corps 7 mm.

Elytres: longueur 7 mm., largeur 3 mm., étendus 16 mm.

Hab. Gorgona Is. (2° 59' N., 78° 20' W.), July 1924 (*L. E. Cheesman*).

(9) *Sphenorhina gorgonæ*, sp. n.

Vertex, pronotum et écusson noir-brunâtre; front, clypeus, rostre, pro- et mésosternum brun-rouge; métasternum, abdomen rouge-carmin; pattes d'un rouge plus ou moins brunâtre. Elytres ocre-jaune, base, clavus, partie voisine de la suture plus ou moins embrunis, partie apicale noire. Ailes enfumées, à nervures brunes et à base rouge.

Front plus bombé que dans l'espèce précédente, à forte carène médiane, vu de côté, dessine un angle droit, saillant. Pronotum à surface irrégulière, à fossettes et pli transversal, assez grossièrement ponctué, à carène médiane. Sur les élytres, médian et cubitus, non soudés, mais réunis par un rameau transverse. Deux épines sur les tibias postérieurs.

Longueur totale 4.5 mm.

Longueur du corps 7 mm.

Elytres: longueur 8 mm., largeur 3 mm., étendus 19 mm.

Hab. Gorgona Is. (2° 59' N., 78° 20' W.), July 1924 (*L. E. Cheesman*).

Cette espèce doit être voisine de *S. conspicua*, Distant, s'en distingue par la coloration du front et des élytres.

(10) *Homalostethus spectabilis*, Burmeister,
var. *impunctata*, nov.

Se différencie de l'espèce par l'absence des taches noires sur la partie antérieure des élytres, la partie noire à son bord antérieur à peu près droit et au niveau du bord interne, il se trouve à une certaine distance de la pointe de l'écusson.

Hab. Philippine Is. (*J. J. Munsey*).

(11) *Locris incarnata*, Distant.

List Hom. Ins. iii. p. 677 (1851).

Var. *obscurata*, nov.

♂. D'un rouge plus foncé, le vertex, sauf les bords, est noir, les bandes du pronotum sont plus larges et la seconde n'est plus coupée en son milieu; les taches des élytres sont plus grandes et au commencement de la partie apicale, les nervures transversales sont jaune-rougeâtre; la taille est un peu plus petite.

♀. Le pronotum, sauf les bords, est noir; les élytres (sauf la plus grande partie du clavus, le bord externe et les nervures apicales) sont noirs; une partie des nervures apicales sont jaunes.

Longueur 9 mm.

Hab. Natal, Van Reenen, Drakensberg, Nov. 1926 (*R. E. Turner*).

(12) *Locris marshalli*, sp. n.

Noire, sauf : une tache arrondie à la base des hanches antérieures et médianes, les hanches postérieures, une fine bordure postérieure des premiers segments abdominaux, la base des ailes et un peu plus de la moitié antérieure du bord externe des élytres, qui sont rouges; la bordure des élytres assez large en avant, s'amincit en arrière, vers la base elle s'étend jusqu'au radius.

Front lisse, recouvert d'une villosité noire assez dense, très proéminent, s'étendant fort en avant du vertex, à carène longitudinale sur la partie antérieure; ocelles petits, proches l'un de l'autre; pronotum assez rugueux, à grandes fossettes antérieures; élytres densément et finement ponctués; une épine sur les tibias postérieurs.

Longueur 10 mm.

Hab. Tanganyika, Kwamkoro, 22. vii. 1927 (*C. B. Williams*).

J'ai le plaisir de dédier cette espèce à Mr. G. Marshall, Director of the Imperial Bureau of Entomology.

LXXVIII.—*Sur les genres Apionichthys, Kp., et Achiropsis, Stdr. [Pisces soleiformes]; description d'une espèce nouvelle.*
Par PAUL CHABANAUD.

L'EXAMEN auquel j'ai procédé, à Vienne, du type d'*Achiropsis nattereri*, Stdr., m'a permis d'apprécier, à leur juste valeur, les différences qui existent entre cette forme et le spécimen du British Museum dont il avait été déjà question dans une note précédente*.

Ces différences sont telles qu'il me paraît opportun de créer, au profit de l'exemplaire de la collection britannique, une espèce nouvelle, que je me fais un agréable devoir de dédier,

* Ann. & Mag. Nat. Hist. ser. 9, vol. xx. p. 528 (1927).

en témoignage d'amitié, à Monsieur J. R. Norman, Assistant d'Ichthyologie au British Museum.

La diagnose de cette nouvelle espèce est consignée dans les lignes qui suivent, à la suite de remarques sur les genres *Apionichthys* et *Achiropsis*, desquels je suis aujourd'hui en mesure de donner une définition plus précise.

APIONICHTHYS.

Apionichthys, Kaup, Arch. Naturg. xxvi. 1, 1858, p. 104.

Corps revêtu d'écaillés. Une seule narine ouverte sur la face oculée; deux narines sur la face aveugle. Yeux très petits. Mâchoires du côté gauche pourvues de dents. Angle du preoperculum distinct extérieurement, par l'effet d'une solution de continuité entre les séries d'écaillés. Peau de la tête attachée à la région pelvienne, réduisant à une courte fente chacune des ouvertures operculaires. Les deux branches de l'urohyal formant entre elles un angle extrêmement aigu (environ 10°); la branche pelvienne de cet os très allongée, déterminant un avancement considérable de la position de la nageoire pelvienne droite, dont le 1^{er} rayon se trouve placé plus ou moins exactement au-dessous de la symphyse mandibulaire. Septum interbranchial ouvert. Base de la pelvienne droite contenue tout entière dans le plan sagittal; pelvienne gauche sénestre, plus ou moins atrophiée. Anus sénestre. Papille urinaire dextre.

Orthotype : *Apionichthys dumerili*, Kp. (= *Soleotalpa unicolor*, Gthr.). Les types d'*Apionichthys ottonis*, Sldr., que j'ai examinés à Vienne, ne diffèrent en rien de ceux d'*Apionichthys dumerili*, Kp. Il est hors de doute que tous ces exemplaires appartiennent à la même espèce et que Steindachner a été trompé par une fausse indication de provenance, lorsqu'il décrivit, sous le nom d'*Apionichthys ottonis*, ceux qu'il croyait avoir été pêchés en Méditerranée.

ACHIROPSIS.

Achiropsis, Steindachner, Sitzungsber. math.-naturw. Cl. K. Akad. Wiss. Wien, Band lxxiv. Abth. 1, 1876 (1877), p. 58.

Ce genre ne diffère du genre *Apionichthys*, Kp., que par les caractères suivants : mâchoires inermes; pelvienne gauche mieux développée.

Orthotype : *Achiropsis nattereri*, Sldr.

- I. Dents remplacées, aux deux mâchoires, par une villosité très dense de la muqueuse. Hauteur = 48 %; tête = 26 % de la longueur sans la caudale *nattereri*.
- II. Muqueuse buccale épaissie à la place des dents, mais sans villosité. Hauteur = 40 %; tête = 18 % de la longueur sans la caudale *normani*.

Achiropsis nattereri, Sldr.

Type : Rio Negro [Naturhistorisches Museum, Wien].

D. 83. A. 61. C. 16. Pelviennes 5 et 5. Écailles (face oculée) 112 ; (face aveugle) 132.

‰ de la longueur du corps : hauteur 48 ; longueur de la tête 26.—‰ de la longueur de la tête : œil 2 ; espace post-oculaire 65 ; longueur de la caudale 92.—‰ du diamètre de l'un des yeux : espace interoculaire 280.—‰ de la hauteur du corps : hauteur de la dorsale 31 ; hauteur de la base de la caudale 33.

Face oculée.—Profil antérieur largement arrondi. Prolongement du museau très long, atteignant presque la base du rayon antérieur de la pelvienne droite. Tube nasal inséré sous l'aplomb du bord antérieur de l'œil dorsal ; le tube court ; son lumen plus grand que l'œil. Bord libre de la lèvre inférieure cilié ; la commissure buccale placée au-dessous de l'œil ventral. Deux lignes sensorielles visibles sur la région supra-temporale, toutes deux dirigées, presque en droite ligne, vers la dorsale ; la ligne antérieure placée au-dessus des yeux et très inclinée vers l'avant ; la postérieure formant un angle obtus avec la ligne latérale. 11 ou 12 écailles entre l'œil ventral et le bord vertical du preoperculum ; environ 16 écailles entre le preoperculum et la fente operculaire. Premier rayon de la dorsale inséré sur le prolongement prébuccal du museau, au-dessus du niveau de l'extrémité antérieure de la fente buccale ; les rayons antérieurs ne dépassant pas la membrane ; le dernier rayon très court et attaché à la caudale, de même que le dernier rayon de l'anale. Caudale rhomboïdale. Premier rayon de la pelvienne droite inséré sous la symphyse mandibulaire ; son dernier rayon attaché à l'anale. Une seule rangée d'écailles (2 à la base) sur chacun des rayons de la dorsale ou de l'anale, au moins sur la région moyenne du corps.

Face aveugle.—Tube nasal antérieure inséré sur le prolongement prébuccal du museau et enfoui dans les franges sensorielles. Narine postérieure percée au-dessus de la commissure buccale. Franges sensorielles longuement sétiformes ; une plage subsemicirculaire, couverte de franges, située immédiatement en arrière de l'ouverture operculaire. Pelvienne gauche parallèle à la pelvienne droite ; ses rayons plus courts ; son 1^{er} rayon symétrique au 3^e de la pelvienne droite.

Coloration en alcool.—D'un brun jaunâtre clair, uniforme. Villosité buccale (remplaçant les dents) brun foncé.

Achiropsis normani, sp. n.

Type: Rio Jurza [*Dr. Bach*, 1897; British Museum].

D. 76. A. 57. C. 16. Pelviennes 5 et 5. Ecaïlles (face oculée) 102; (face aveugle) 116. Vertèbres $8 + 31 = 39$.

$\frac{1}{10}$ de la longueur du corps: hauteur 40; longueur de la tête 18.— $\frac{1}{10}$ de la longueur de la tête: œil 5; espace post-oculaire 54; longueur de la caudale 104.— $\frac{1}{10}$ du diamètre de l'un des yeux: espace interoculaire 140.— $\frac{1}{10}$ de la hauteur du corps: hauteur de la dorsale 23; hauteur de la base de la caudale 27.

Cette espèce diffère de *Achiropsis nattereri*, Stdr., par les caractères suivants:

Forme plus allongée. Tête proportionnellement plus courte. Prolongement prébuccal du museau plus court, recouvrant la symphyse mandibulaire, mais séparé de la pelvienne par un intervalle aussi grand que la distance comprise entre les centres des deux yeux. Ecaïlles plus grandes: 9 ou 10 entre l'œil ventral et le bord vertical du preoperculum, environ 12 entre le preoperculum et la fente operculaire. Pas de villosité à la place des dents.

Coloration identique.

LXXIX.—*Notes on the Cephalopoda*.—IV. On *Octopus ægina*, Gray; with Remarks on the Systematic Value of the Octopod Web. By G. C. ROBSON, M.A.

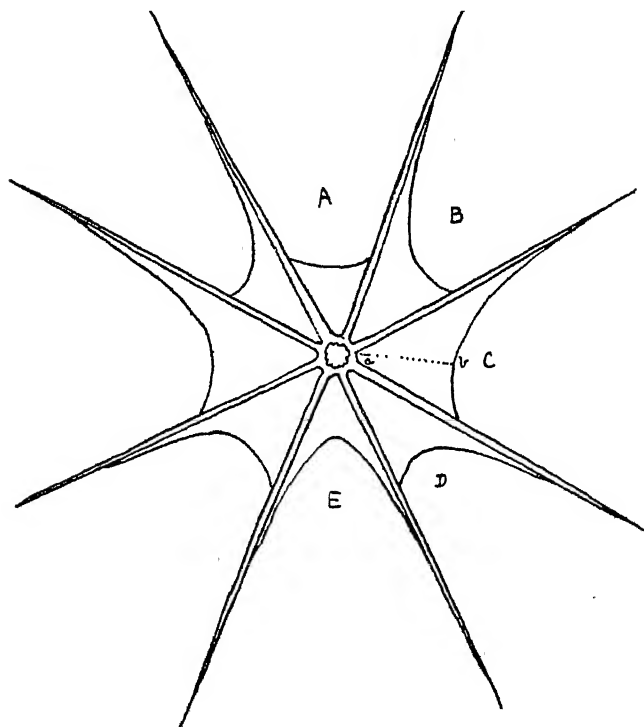
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In the course of the preparation of a catalogue of the Octopoda in the British Museum it has been necessary to examine and redescribe the types of J. E. Gray's Octopod species, which were incompletely described by that author in his 'Catalogue' (1849). One of these species having special features of taxonomic interest is here described.

In drawing up this description I have availed myself, far more than students of the Cephalopoda have done in the past, of the characters of the web. The relative size of the various sections and the general form appear to me to be of great diagnostic value in dealing with this difficult group. A diagram of a typical web is given with the various sections lettered, and it is recommended that a web-formula (similar to the arm-formula) be used, the order of the

letters in the formula indicating the size-order of the sections. Thus the formula for the web illustrated in fig. 1, in which the sections (measured along the line *a-b*) are A 30, B 45, C 50, D 53, and E 27 mm. respectively, would be D. C. B. A. E. If desired the letter *e* can be added in brackets to indicate that the web sends extensions up to the edges of the arms.

Fig. 1.

Diagram of web of *Octopus*.*Octopus ægina*, Gray.

Octopus ægina, Gray, 1849, p. 7; Hoyle, 1886, p. 221 (as "insufficiently characterized"); Tryon, 1879, p. 111 (from Gray, *l. c.*).

1. One specimen (♀) from unknown locality: B.M. 1928. 2.14.1. (Type.)
 2. One specimen (♂) from "China": B.M. 52.1.1.4.
- Distribution*, ? China (only known from specimen No. 2).

Fig. 2.

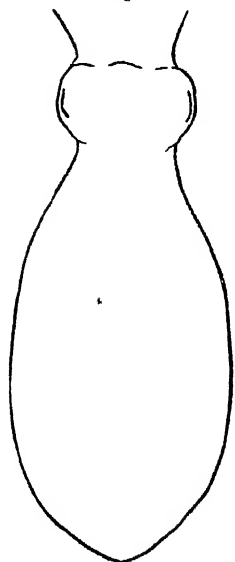
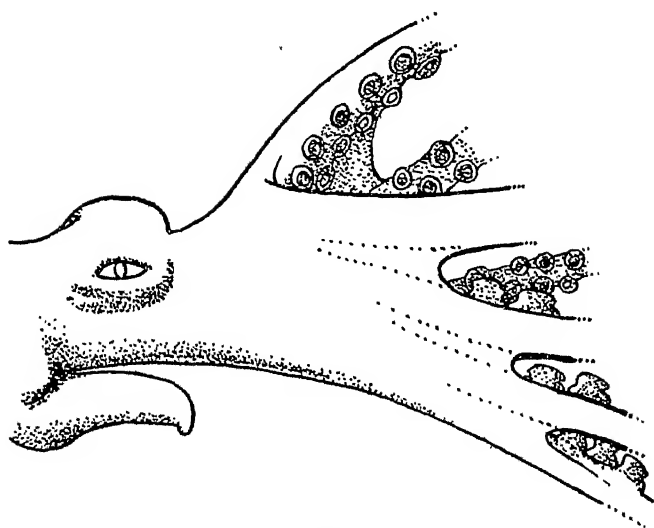


Fig. 3.



Octopus ægina, Gray.

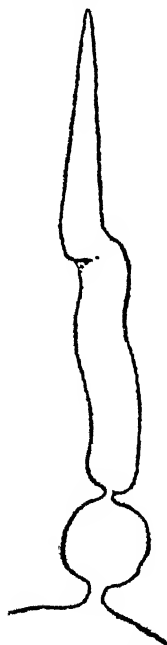
Fig. 2.—Outline of mantle. $\times 2$.

Fig. 3.—Profile of head and base of arms showing scoop-like web.

This very interesting species, represented by two specimens, is very distinctive, and I know no other form which it even remotely resembles.

The mantle and head are narrow and long (the width of the former is 48 per cent. of its length, and the width of the head is 32 per cent. of the mantle). The eyes are very prominent and the head very small. The arms are exceptionally delicate and taper to fine points. The suckers are small and the largest do not exceed 7·7 per cent. of the mantle-length. The arms are in the order L. 4, 3, 2, 1 : R. 4, 3, 2, 1, and the longest arms are 77 per cent. of the

Fig. 4.

*Octopus ægina*. Oviduct. $\times 4$.

total length. The mantle-aperture is moderate (type B, Robson). The web is highly characteristic. I have devoted much time to the study of the web as a means of diagnosis in Octopoda, and though I have not yet completed this study I have to admit that so far the web of *O. ægina* is unlike that of any other species of *Octopus**. Usually the

* Steenstrup's MS. name *Schizoctopus* was proposed for those species with section A very short. *O. rugosus* (Bosc), regarded as an example of this group, has section A of the web tolerably long.

web has interspace A either a little larger or a little smaller than E, and the deepest section is either C or D. In *O. ægina* A is less than half the size of E, and the sections are progressively deeper from before backwards. This gives the animal a very uncommon appearance when seen in profile, and the web has a curious shovel-like appearance. The web is moderately long (24 per cent. of the longest arm) and the "disparity index" * is 48). The funnel is free for $\frac{1}{3}$ of its length. It has a very weak locking-apparatus, and no trace of a funnel organ can be found. There are seven external and eight internal filaments in the two demibranchs. The oviduct is very characteristic (fig. 4), the distal section being stout and divided into two parts; the proximal section is very short. The oviducal gland is moderate in size. The colour of the animal is a dull reddish-ochreous ground covered by a very neat pattern consisting of fine longitudinal and anastomosing lines on the dorsum and head and a very delicate reticulation on the arms. The pattern is absent on the ventral surface, and here the reddish tint is very faint. The animal is completely smooth.

Dimensions (in mm.).

Mantle—length, apex-eye.....	58	
„ width	27	
Head, maximum width	19	
	R.	L.
Arm 1	157	100
2	170	180
3	187	192
4	188	198
Web, depth between arm 1-1	18	
1-2	36	
2-3	44	
3-4	48	
4-4	46	

The specimen from China which I have included here is extremely like the type of *O. ægina*. In fact, the only point of difference is that in the Chinese specimen the neat reticulation is absent, the animal being more or less colourless. The agreement in web-pattern and other proportions is very close. Additional data may be given concerning this specimen. The web is 27 per cent. of the longest arm and the "disparity index" is 47 per cent. The gills have nine

* I introduce this term for the first time. It denotes the difference in length between the longest section and the smallest section of the web expressed as a percentage of the mantle-length.

filaments a side and the inner demibranch is reduced by one-third. The rhachidian tooth of the radula has an A_4 seriation (Robson, 1925). The adlateral is very long. The second lateral is devoid of an ectocone, but has a marked "heel." The adductor pallii medialis forms a septum which is in length 17 per cent. of the total mantle-length. The hectocotylus is undeveloped. The penis has a well-marked appendix of the *O. rugosus* type, and is very long (33 per cent. of the mantle-length).

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 ROBSON, G. C. 1925. Journ. Linn. Soc. London, xxxvi. p. 99.
 TRYON, G. 1879. Manual of Conchology, i.

LXXX.—Notes on the Cephalopoda.—V. On the Oviposition of *Octopus rugosus*. By G. C. ROBSON, M.A.

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THE use of the "shell" in *Argonauta* as a brood-chamber and its origin from the membranous expansions of the dorsal arms is one of the most singular phenomena in Molluscan structure and bionomics. In a paper shortly to be published I hope to review our knowledge of this subject and to add some personal observations thereto. In the meantime, I think it desirable to place on record an interesting case which has some bearing on Naef's theory ("Die Fossilen Tintenfische," 1922) as to the origin of this interesting structure.

Naef believes that the resemblance between the Argonaut shell and that of the extinct Ammonite may be explained by assuming that the ancestral Argonaut took to laying its eggs in empty Ammonite shells, and that the epidermis of the arms used in supporting and cradling this brood-chamber was stimulated by the pressure and secreted a calcareous envelope around the nucleus provided by the foreign shell. I do not wish to say anything in this paper concerning this ingenious and somewhat improbable explanation; nor do I wish to raise the question as to whether the Argonaut shell is, in fact, sufficiently like that of an Ammonite to necessitate such a hypothesis.

The object of this note is to add a piece of confirmatory evidence to Naef's statement that the habit of laying eggs in shells of other molluscs is not unknown in the modern Octopodidæ. He cites the observations of Perrier and

Rochebrune, who state that *Octopus digueti*, a Californian species, lays its eggs in the empty valves of *Pecten* and *Cytherea*.

In the British Museum collection of Octopoda I have recently come across a specimen of *Octopus rugosus* (Zool. Dept. 1906.9.16.1-2), obtained from Travancore, which is preserved along with a mass of Octopod eggs presumably of the same species which are suspended inside valves of a species of *Mytilus*.

At the same time it is of interest to note that Hornell (Madras Fisheries Dept. Report 6, 1921, p. 202), in describing the fauna of the Gulf of Mannar recorded that "small Octopods are common on the pearl-banks during a fishery, and it is not uncommon to find their tiny colourless eggs attached to the inside of an empty pearl-oyster shell." On p. 201 he records the fact that he often found small Octopods hiding in such shells. Whether we are entitled to attach as much significance to these cases of oviposition in foreign shells as Naef would wish, is at present doubtful.

In most groups of animals which attach their eggs to solid objects on the sea-bottom there is no doubt a certain amount of variation in the type of substratum chosen. Not a great deal is known concerning the oviposition of *Octopus* and its allies. It seems as if the eggs were most often attached to the rocks and large stones surrounding the lair. Occasional deviations from this habit such as those recorded for *O. digueti*, *O. rugosus*, and Hornell's "small Octopod" (? = *O. rugosus*) need not be construed as implying a definite and innate preference for empty shells as a place for oviposition, such as might afford a basis for a hypothesis like that of Naef.

It remains to be seen if further observation can supplement the three records mentioned herein.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

February 8th, 1928.—Dr. F. A. Bather, M.A., F.R.S.,
President, in the Chair.

The following communication was read :—

'The Geology of the District around Dinas Mawddwy (Merioneth).' By Prof. William John Pugh, O.B.E., B.A., F.G.S.

The Dinas Mawddwy area includes about 22 square miles of country in South-Eastern Merioneth. It forms part of the

Central Wales Plateau, and is dissected by deep valleys, somewhat modified by glacial action.

The rocks consist of mudstones, shales, and slates, with subordinate bands of grit and limestone. They belong to the Bala and the Valentian Series. The succession is similar to that in the adjacent area around Corris,¹ and the same classification has been retained. There are, however, certain lateral changes within the Bala Series, both in lithology and in fauna.

The Upper Coiswyn Beds change in a north-easterly direction from barren, grey-blue, slaty mudstones, into rusty-weathering calcareous mudstones, which yield *Trinucleus caractaci*, *Dalmanella* cf. *testudinaria* var. *shallockensis*, *Cliftonia spiriferoides*, *Asaphus powisi*, etc.

The black graptolitic shales of the Nod Glas persist throughout the area; but north of Dinas Mawddwy they include thin, dark, argillaceous limestone-bands, which yield in fair abundance *Plectambonites sericea* cf. var. *thraivensis* and *P.* cf. *papillosa*. These calcareous bands are recorded on the Geological Survey map² as the Bala Limestone.

The Garnedd-wen Beds change from a massive sandy mudstone-group in the west, to a mainly fine-grained shale series in the east. *Phacops mucronatus* occurs in the mudstones which intervene between the Narrow Vein and these rusty-weathering shales. The latter are apparently devoid of fossils.

The succession is compared, so far as possible, with those of Plynlimon, Bala, and the South-Western Berwyn Hills.

The Dinas Mawddwy country is located on the south-eastern flank of the Harlech Dome, and the fact that the rocks are folded around that great anticline determines the general direction of the strike, which is from south-west to north-east; but the region has been folded along north-and-south axes, and some of these folds are correlated with important structures farther south in Central Wales, as, for example, the Teify Anticline, etc.

The faults trend in three directions: (1) north and south; (2) north-east and south-west; (3) north-west and south-east. The north-and-south faults were probably formed at the same time as the folding. The north-west and south-east faults are parallel to the general direction of the dip, which is south-eastward, and they probably belong to a later period of movement than the strike-faulting (south-west to north-east).

The rocks are intensely cleaved, and the strike of the cleavage-planes is practically parallel to the general strike of the strata. The cleavage-planes are either vertical or highly inclined south-eastwards. Since they are unaffected by the folding, it is inferred that the cleavage was formed after the folding.

¹ W. J. Pugh, Q. J. G. S. vol. lxxix (1923) pp. 508-41.
1-inch Sheet, O. S. 60 N.W.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[TENTH SERIES.]

No. 6. JUNE 1928.

LXXXI.—*Notes on the Classification of the African Monkeys in the Genus Cercopithecus, Eräleben.* By ERNST SCHWARZ.

IN 1893 Sclater* published a revision of this genus which embodies the bulk of African monkeys. This paper was supplemented by Matschie†, but for fourteen years no attempt was made to put into order the many species described since Sclater's fundamental note. In 1907 Pocock‡ brought out an entirely new revision, arranging the species then known into thirteen groups, which, however, contained *Allenopithecus nigroviridis* and the red species since separated as a distinct genus—*Erythrocebus*, Trouessart. Elliot's§ account is more or less an emendation of Pocock's paper, Pocock's groups being mostly raised to subgeneric rank. Finally, Allen's|| most important revision, which gives a review of the whole subject and a full list of the literature, is principally based on Pocock and Elliot, and deals mainly with the forms collected by Messrs. Lang and Chapin in the Belgian Congo.

When recently the author took up this subject, which was

* P. Z. S. pp. 243-58 (1893).

† Sb. nat. Fr. pp. 212-16 (1893).

‡ P. Z. S. 1907, ii. pp. 677-746 (1907).

§ Rev. Primates, ii. pp. 273-382 (1913).

|| Bull. Am. Mus. Nat. Hist. xlvii. pp. 349-418 (1925).

actually his first, though unpublished, attempt when he began mammalogical work more than twenty years ago, he found Pocock's and Allen's work a most useful basis for his studies. Several contradictory statements, however, had to be investigated, and the considerable number of doubtful forms re-examined to settle their real status. When, with the help of an extensive material in the Berlin, British, Tring, Quex, Paris, Tervueren, Leiden, and Frankfort Museums a general view had been obtained, it was found that the 159 forms described up to now * could be arranged into ten groups, each composed of a number of geographical forms which replace one another locally, and are generally connected by intermediate stages, thus constituting simply specific sections. All of these species are themselves rather closely allied, and in certain cases their relationships may be reconstructed. A full account of the characters of the genus as a whole, including a description of the skeletal characters, is being prepared. As a preliminary result the following list of the species, as they now stand, is presented. No attempt is made for the present to point out the relations of the various groups *inter se*.

I. *Cercopithecus æthiops*, Linnæus.

As a detailed account † has been recently given, no further remarks are necessary on this group.

1. *Cercopithecus æthiops centralis*, O. Neumann.

Syn.: *budgetti*, Pocock; *griseistictus*, Elliot; *itimbiensis*, Matschie et Dubois; *benianus*, Lorenz; *graueri*, Lorenz.

2. *Cercopithecus æthiops marrensis*, Thomas & Hinton.

3. *Cercopithecus æthiops tantalus*, Ogilby.

Syn.: *chrysurus*, Blyth; *passargei*, Matschie; *alexandri*, Pocock; *viridis*, A. Schultze.

4. *Cercopithecus æthiops sabæus*, Linnæus.

Syn.: *weneri*, I. Geoffroy; *callithrichus*, I. Geoffroy.

Both the type-series of *weneri* and *callithrichus* have been

* *Cercopithecus Temminckii*, Ogilby, Libr. Entert. Knowl., Menageries i. p. 345 (1838), is obviously not a species of this genus, but a misquotation (generally repeated) of *Colobus Temminckii*, Kuhl = *Colobus badius temminckii*, Kuhl.

† Zeitschr. f. Säugetierk. i. pp. 28-47 (1926).

examined at the Paris Museum and found essentially to agree with one another. All the specimens are from the menagerie at the Jardin des Plantes. The following specimens are here designated as lectotypes :—

weneri: Mus. Paris, Gallery no. 196, ♂ semiad., Ménagerie, 1847; “Un des types” (no. 197 is a paratype).

callithrichus: Mus. Paris, Gallery no. 193, Ménagerie, 1810; “Type” (nos. 192–95 are marked “type”).

5. *Cercopithecus æthiops æthiops*, Linnæus.

Syn.: *eugytitthia*, Hermann; *griseoviridis*, Desmarest; *subviridis*, F. Cuvier; *griseus*, F. Cuvier; *cano-viridis*, Gray; *cinereo-viridis*, Gray; *toldti*, Wettstein; *cailliaudi*, Wettstein; *weidholzi*, Lorenz.

Since my revision of this group was published, additional material of this form from various localities on the White Nile (Renk, Senaar, White Nile, 14° N.), Dinder River (Kamisa), and Abyssinia (Tacazze River, Gonda, Morowa) have been examined in the British Museum, and shows, as has been supposed, the differences upon which *cailliaudi* and *griseoviridis* were separated by Dr. v. Wettstein to be only individual aberrations. A specimen from Omdurman does not appreciably differ, and affords sufficient evidence of the status of *toldti*.

6. *Cercopithecus æthiops hilgerti*, O. Neumann.

Syn.: *ellenbecki*, O. Neumann; *djamdjamensis*, O. Neumann.

7. *Cercopithecus æthiops matschiei*, O. Neumann.

8. *Cercopithecus æthiops rufoviridis*, O. Neumann.

Syn.: *flavidus*, Peters; ? *circumcinctus*, Reichenbach; *whytei*, Pocock.

9. *Cercopithecus æthiops johnstoni*, Pocock.

Syn.: *rubellus*, Elliot; *luteus*, Elliot; *tumbili*, Heller; *contiguus*, Hollister.

10. *Cercopithecus æthiops callidus*, Hollister.

11. *Cercopithecus æthiops nesiotus*, Schwarz.

Syn.: *pembæ*, Matschie.

12. *Cercopithecus æthiops excubitor*, Schwarz.

Syn.: *voeltzkowi*, Matschie.

13. *Cercopithecus æthiops arenarius*, Heller.14. *Cercopithecus æthiops pygerythrus*, F. Cuvier.

Syn.: *pusillus*, Desmoulins; *erythropyga*, G. Cuvier; *lakundii*, L. Geoffroy.

15. *Cercopithecus æthiops helvescens*, Thomas.16. *Cercopithecus æthiops cynosuroides*, Scopoli.

Syn.: *tephrops*, Bennett; *silaceus*, Elliot; *weynsi*, Matschie & Dubois; *tholloni*, Matschie; *lukonzolwa*, Matschie; *katangensis*, Lönnberg.

The types of the forms described by Matschie, Elliot, and Lönnberg have been examined and found to belong here. The range of *cynosuroides* is thus enormously increased. A more detailed account and a full description will be published at an early date.

II. *Cercopithecus leucampyx*, Fischer.

The forms regarded here as subspecies of *C. leucampyx* have been divided into two groups (the *leucampyx* and *albogularis* groups respectively) by Pocock, and even regarded as representative of two subgenera (*Melanocebus* and *Insignicebus*) by Elliot. As has been pointed out elsewhere, there are, however, transitional forms between the green-backed, black-headed *leucampyx* to the red-backed, pale-headed *albogularis* type. In the Katanga and Bangwcolo region there is a grey-headed "*leucampyx*," *C. l. opisthostictus*; *C. l. boutourlinii* of Southern Abyssinia and *C. l. albotorquatus* from the Juba River are perfectly intermediate between *C. l. stuhlmanni*, a typical representative of the "*leucampyx*" section, and *C. l. kolbi*, a form of the eastern "*albogularis*" type.

1. *Cercopithecus leucampyx leucampyx*, Fischer.

Syn.: *diadematus*, L. Geoffroy; *pluto*, Gray; *nigrigenis*, Pocock.

Dark specimens of this group with a very light superciliary band are not uncommon in Zoological Gardens. At present there are five at Berlin. They all agree fairly well with Geoffroy and Cuvier's plate of the "*Diane femelle*" upon which *leucampyx* was founded. Apart from differences of age and sex, the first of which accounts for the dark cheeks

in "*nigrigenis*," there is not very much individual variation. There are no type-specimens of *leucampyx* and *diadematus* at Paris now; but those of *pluto* and *nigrigenis* are at the British Museum, where they have been examined. The habitat of typical *leucampyx* is still unknown, all the specimens in existence being menagerie specimens of doubtful origin; perhaps, after all, Angola, where the type of *pluto* was said to come from, is the place.

2. *Cercopithecus leucampyx maesi*, Lönnberg.

3. *Cercopithecus leucampyx opisthostictus*, Sclater.

No. 94.3.3.22 in the British Museum, a native-made skin, is here designated as lectotype.

4. *Cercopithecus leucampyx stuhlmanni*, Matschie.

Syn.: *otoleucus*, Sclater; *carruthersi*, Pocock; *princeps*, Elliot; *schubotzi*, Matschie; *elgonis*, Lönnberg.

Type-specimens:—

stuhlmanni. Mus. Berlin no. 33622. Kinyawanga, Semliki River (*Emin Pasha coll.*) (mounted skin and skull).

otoleucus. Brit. Mus. no. 11.2.24.3. Latuka Mts., N. Uganda (*Maj. Delmé Radcliffe*). Kept alive at the London Zoo, 1.3.1902–29.1.1911.

carruthersi. Brit. Mus. no. 6.7.1.1. Ruwenzori East, 10,000 feet (*D. Carruthers*).

princeps. Brit. Mus. no. 7.4.6.6. Ft. Portal, Mpanga Forest, Toro, Uganda (*R. E. Dent*).

schubotzi. Mus. Berlin no. $\frac{33607}{33608}$. Mawambi, Ituri River (*Dr. H. Schubotz*).

As has been pointed out by Dr. Allen*, the differences said to be characteristic of *carruthersi*, *princeps*, and *schubotzi* come within the normal range of variation of *stuhlmanni*. The type of *schubotzi* is actually the specimen most like that of *stuhlmanni* which I have examined. The type-specimen of *otoleucus* is a very old male; the fur is shorter than in other specimens I have seen, but this is undoubtedly due to captivity. Except that, there is absolutely nothing to distinguish it from *stuhlmanni*.

* Bull. Am. Mus. Nat. Hist. xlvii. p. 399 (1925).

5. *Cercopithecus leucampyx neumanni*, Matschie.Syn.: *mauæ*, Heller.6. *Cercopithecus leucampyx doggetti*, Pocock.Syn.: *sibatoi*, Lorenz.

The type of *doggetti* has been compared with a topotype of *sibatoi* in the British Museum and a long series of specimens at Berlin, and found to be perfectly identical.

7. *Cercopithecus leucampyx kandti*, Matschie.Syn.: *insignis*, Elliot.8. *Cercopithecus leucampyx moloneyi*, Slater.Syn.: *francescæ*, Thomas.

C. francescæ is based on a native-made skin without face, hands, and feet, now carefully made into a museum specimen. After careful consideration I have come to regard it as a young specimen of *moloneyi*. It has the long loose pelage and the full and silky-haired pale throat-patch. On the whole, it is slightly darker below and on the sides, and lacks the pale tips of the hairs found in the adult. The rump is less brightly rufous and more with a greenish tinge, the subapical band of the individual hairs being lighter. A young skin in the Berlin Museum from Ufipa, east of southern Lake Tanganyika, collected by Dr. Fülleborn, is very similar.

9. *Cercopithecus leucampyx boutourlinii*, Giglioli.Syn.: *omensis*, Thomas.10. *Cercopithecus leucampyx albоторquatus*, Pousargues.Syn.: *rufotinctus*, Pocock *; *zammaraoui*, de Beaux.

The type of *C. albоторquatus* is a mounted specimen, still on exhibition in the gallery of the Paris Museum, with the skull inside. It is an immature male and in good condition. As the type of *rufotinctus* this appears to be a somewhat abnormal individual much affected by erythrism and partial albinism. It is at once conspicuous by the enormous extension of the throat-band, which occupies the whole lower half of the cheeks, and on the neck only leaves a narrow

* Cf. Ann. & Mag. Nat. Hist. (9) xix, p. 153 (1927).

strip in the middle of the normal colour; it is sharply set off everywhere. Lower surface and inside of arms and thighs white. On the other hand, the outside of the arms is black, this colour being extended far up to the shoulders; thighs also very dark. The whole of the upper side, including the head, is strongly tinged with rufous, but there are no ear-marks as in "*stairsi*." This rufous coloration is most conspicuous in the pygal region, the lower side of the base of the tail, and the posterior surface of the thighs, but absent on the root of the tail above and the lower back. As a whole, the specimen may be regarded as an individual aberration from the type, the normal phase of which has been described as *zammaraoui*, and even more deviating from it than *rufotinctus*.

11. *Cercopithecus leucampyx phylax*, Schwarz.

12. *Cercopithecus leucampyx kolbi*, O. Neumann.

Syn.: *hindei*, Pocock; *nubilus*, Dollman.

A rather long series of this race shows the two forms described by Pocock and Dollman to come within the range of individual variation of *kolbi*.

13. *Cercopithecus leucampyx kibonotensis*, Lönnberg.

Syn.: *kima*, Heller; *maritima*, Heller.

The characters upon which Heller's names are found do not appear to be more than individual or age differences.

14. *Cercopithecus leucampyx albogularis*, Sykes*.

Type: B.M. no. 55.12.24.13, ♂. Zoological Society's Museum. Skin and skull.

15. *Cercopithecus leucampyx monoides*, I. Geoffroy.

Syn.: *rufilatus*, Pocock.

The type-specimen of *C. monoides* is still in the Paris Museum, where by the kind permission of Messrs. Bourdelle and Anthony I have been able to examine it. The skull is in the Department of Comparative Anatomy; it belongs to an old female in excellent state of preservation, but much changed by captivity, and therefore without much systematic

* Cf. Ann. & Mag. Nat. Hist. (9) xix. p. 152 (1927) (type-locality fixed; Zanzibar).

value (Anat. Comp. Catalogue no. I.79; old register A.1352). The skin is mounted and exhibited in the gallery (Gallery no. 150; Cat. Général entry: 22.10.1838; Princesse de Baudeau. "Sorti de l'alcool"). The specimen is in good condition and perfectly agrees with the original figure; the face is (wrongly) painted as in the *mona* group. The character of the throat-band, the grey, not whitish, lower surface, and the ochry colour of the back are the same as in the local race from southern Tanganyika Territory to which the name *rufilatus* has been applied by Pocock. The brownish tinge on the underside and extremities by which it apparently differs from *rufilatus* is undoubtedly due to the specimen's original preservation in alcohol.

As no type-specimen has been selected by Mr. Pocock, the following lectotype of "*Cercopithecus albogularis rufilatus*" is here designated:—

Brit. Mus. no. 78.12.26.1, ♂ subad. Rufiji River, 8° S.
(Capt. Wharton). Skin and skull.

16. *Cercopithecus leucampyx nyasæ*, subsp. n.*

17. *Cercopithecus leucampyx erythrarchus*, Peters †.

Syn.: *stairsi*, Selater; *beirensis*, Pocock; *mossambicus*, Pocock.

* *Cercopithecus leucampyx nyasæ*, subsp. n.

Type-locality: Ft. Lister, Mlanje, S. Nyasaland; elevation 3500 feet.

Type: B.M. no. 94.1.25.1. Old ♂; collected by A. Whyte on July 16, 1893.

The specimens of White-throated Guenon from the mountains east of Lake Nyasa are closely related to *C. l. erythrarchus* from Beira and the northern Transvaal, and are in some way intermediate between it and the more northern *monoides*. As a whole, they are darker on the back and thighs than *erythrarchus*, and more strongly tinged with rufous above, though much less so than *monoides*. The rusty patch above the root of the tail generally found in *erythrarchus* is only present in the young and always distinctly darker. On the other hand, the lower surface is decidedly paler than in *monoides*, but also distinctly grayer than in *erythrarchus*. Inside of thighs with just a yellowish tinge, and throat occasionally (especially in junior specimen) with a slight brownish hue.

Eight specimens examined in the British and Paris Museums from the following localities:—Ft. Johnston [Lake Nyasa], Manzi [E. shore of Lake Chilwa], Mt. Chiradzulu, Ft. Lister [Mt. Mlanje] (*type*), Chirinda Forest (all B.M.). "Région des Lacs" (*coll. Foà*) (Paris Museum).

† Cf. Ann. & Mag. Nat. Hist. (9) xix. p. 151 (1927).

18. *Cercopithecus leucampyx labiatus*, I. Geoffroy.

Syn.: *samango*, Sundevall.

Type of *labiatus*: Paris Museum, Gallery no. 152, ♂ imm.
 "Type."

III. *Cercopithecus mona*, Linnæus*.

1. *Cercopithecus mona campbelli*, Waterhouse.

Syn.: *burnetti*, Gray.

2. *Cercopithecus mona lowei*, Thomas.

3. *Cercopithecus mona mona*, Schreber.

4. *Cercopithecus mona grayi*, Fraser.

Syn.: *erzlebei*, Dahlbom et Pucheran; *pallidus*, Elliot; *petronellæ*,
 Buttikofer.

5. *Cercopithecus mona nigripes*, Du Chaillu.

6. *Cercopithecus mona pogonias*, Bennett.

7. *Cercopithecus mona wolff*, A. B. Meyer.

8. *Cercopithecus mona pyrogaster*, Lönnberg.

9. *Cercopithecus mona elegans*, Matschie & Dubois.

10. *Cercopithecus mona denti*, Thomas.

Syn.: *liebrechtsi*, Dubois & Matschie.

IV. *Cercopithecus l'hoesti*, Sclater.

This is a natural group characterised by a number of characters in the condition of the fur, markings, and skull. They are long and soft-haired animals, with hairy noses and long conspicuous hairs below the root of the tail, extending considerably down the tail itself. There are pale infraorbital marks on the face, the underside is blackish, the tail silvery grey, and in both *l'hoesti* and *preussi* the throat-patch shows a tendency to extend in the direction of the sternum. In the skull the considerable extension of the *pars horizontalis*

* No details are given here, a full account of the whole group being forthcoming.

of the palatine bone and the high cusps of the cheek-teeth are most conspicuous.

1. *Cercopithecus l'hoesti l'hoesti*, Sclater.

Syn.: *thomasi*, Matschie; (*thomasi*) *rutschuricus*, Lorenz.

There is no appreciable difference between the type of *l'hoesti* (B.M. no. 8. 5. 7. 4) and the "*thomasi*" series at Berlin, except minor aberrations in the shade of colour and the much shorter coat in *l'hoesti*, both caused by confinement.

2. *Cercopithecus l'hoesti preussi*, Matschie.

Syn.: *crossi*, Forbes; *insularis*, Thomas.

The differences described for the Fernando Po race appear to be only individual.

V. *Cercopithecus hamlyni*, Pocock.

Syn.: *aurora*, Thomas & Wroughton.

This remarkable form is hitherto known by only five specimens: the type at Tring, the type of *aurora*, a native-made skin, in the British Museum, two native-made immature skins at Tervueren, and the young specimen described by Dr. Allen* at New York. I have examined the four first specimens.

The very soft fur, the black belly, the pale face-marks, well seen in Elliot's photograph of the type, the hairy nose, and silvery tail are all characters found in *C. l'hoesti*. The same may be said of the high cusps in the cheek-teeth and the shape of the palatine bone. The presence of a white longitudinal stripe on the nose, the somewhat shorter, although still conspicuous, hairs at the root of the tail, and the absence of the red area on the back do not, for the present, allow me to unite this form with *C. l'hoesti*, with the very scanty material, including a single skull of a baby†, much changed by confinement, which is before me. It is, however, very probable that more material will furnish sufficient evidence to prove the specific identity of *C. hamlyni* with the *l'hoesti* group.

As has been pointed out by Pocock, there is, of course,

* Bull. Am. Mus. Nat. Hist. xlvii. p. 348 (1925).

† That of the type, kindly lent by Lord Rothschild and Dr. Hartert.

no need for a separate genus *Rhinostigma*. Elliot has confounded the type-skull of *Cercocebus hamlyni*, Pocock, which is the same as *Cercocebus aterrimus*, with the type-skull of the present form.

VI. *Cercopithecus neglectus*, Schlegel.

Syn.: *brazzæ*, Rivière; *brazziformis*, Pocock; *ezræ*, Pocock; *uelensis*, Lönnberg.

The type of *neglectus* is a native-made skin, and smoked in the process of preparation, which accounts for the brownish hue mentioned by Elliot. As it has been obtained by Consul Petherick on the White Nile, where the species does not occur, there is every probability that it has come from farther south, *e.g.*, the Niam-niam or Mangbetu country, which is practically the type-locality of *uelensis*. As a matter of fact, apart from the differences produced artificially, this is quite a normal specimen. The differences described for *brazziformis* are within the range of individual variation and equalled by one specimen of the Bates series from the Como River, Gaboon (B.M. 60. 4. 20. 7). The coloration characteristic of the so-called *ezræ* (type: B.M. 9. 7. 19. 2) is the juvenile coloration, which is tinged with brownish all over the body, and lacks the black brow-band and tail; both are developed as the animals grow up. Five specimens of this type have been observed alive during the last two years: one at Frankfort, two at Berlin, and two at Antwerp. In the first three the development of the black markings could be followed. The original series of *brazzæ* has been compared in the Paris Museum; there are two mounted specimens and a good skin with skull—this last (Cat. Gén. No. 1886-115; Congo Français, Brazza) is now selected as type.

VII. *Cercopithecus diana*, Linnæus.

1. *Cercopithecus diana diana*, Linnæus.

Syn.: *ignitus*, Gray.

2. *Cercopithecus diana roloway*, Schreber.

Syn.: *palatinus*, Wagner.

VIII. *Cercopithecus nictitans*, Linnæus.

The white-nosed Guenons form a natural group and

replace one another locally. Except the white nose-spot, peculiar face-markings, and texture of the fur, they all have the characteristic broad and flat nasals, which at once distinguish their skull from all other species of the genus.

1. *Cercopithecus nictitans büttikoferi*, Jentink.

2. *Cercopithecus nictitans petaurista*, Schreber.

Syn.: *albinasus*, Reichenbach; *fantiensis*, Matschie; *pygrius*, Thomas.

The type of *fantiensis* is a baby specimen in the Berlin Museum (♂, no. 2963, "Guinea"; purchased from Gerrard's); except by characters of youth it does not differ from ordinary *petaurista*. The specimen used for comparison by Matschie as representing true *petaurista* (Mus. Berlin, no. 64, juv.) is a very dark individual, but undoubtedly belongs to this race.

The type of "*C. büttikoferi pygrius*" is a specimen of the pale phase; there is a narrow parieto-occipital band. The pale colour of the hams and flanks would appear to be merely an individual character, being almost paralleled in a specimen of *petaurista* from the Gold Coast in the Leiden Museum. A specimen from Aniasué, French Ivory Coast, in the Paris Museum (Cat. Gén. No. 1895-10; coll. Moskovitz) is perfectly typical of *petaurista* *.

3. *Cercopithecus nictitans erythrogaster*, Gray.

Three more specimens have been examined since my last note †—two at Paris, one at Berlin, all without locality and with a red belly.

4. *Cercopithecus nictitans martini*, Waterhouse.

Syn.: *ludio*, Gray; *stampflii*, Jentink; *insolitus*, Elliot†.

5. *Cercopithecus nictitans nictitans*, Linnæus.

Syn.: *laglaizei*, Pocock; *sticticeps*, Elliot.

The characters upon which both *laglaizei* and *sticticeps* have been separated are scarcely marked, although *sticticeps* appears to be more of the greenish phase; all the differences

* This specimen has been sent to the Paris Museum with two skins of *C. mona lowei* from the same locality.

† L. c. p. 154 (1927).

are perfectly within the range of individual variation found in specimens from the same locality.

6. *Cercopithecus nictitans signatus*, Jentink.

Only two specimens known—the type at Leiden and a second specimen in the British Museum, both from captivity and without definite locality. They have both been examined and found to agree in all essential characters.

7. *Cercopithecus nictitans ascanius*, Audebert.

Syn. : *melanogenys*, Gray ; *histrio*, Reichenbach ; *picturatus*, Santos.

The type of *ascanius* is no longer in existence. Of the type of *melanogenys* I have only been able to trace the skull (B.M.) ; as it is not satisfactorily determinable—moreover, that of a young animal,—I propose to place *melanogenys* into the synonymy of *ascanius* ; the original plate is not characteristic enough to help in identifying the exact status of this form, except that it shows it to belong to the red-tailed section of the species. Reichenbach's *histrio* is not described nor figured accurately enough to be exactly identified, and, to avoid future confusion, is here definitely placed among the synonyms of *ascanius*. I have not seen Santos's *picturatus* ; it is provisionally enumerated here.

Lönnberg's* designation of this race to typical *ascanius* may be regarded as final, as no type has been preserved in the Paris Museum ; there is no prospect therefore of new evidence which might upset this decision.

8. *Cercopithecus nictitans whitesidei*, Thomas.

Syn. : *omissus*, Matschie ; *cirrhorhinus*, Matschie ; *kassaicus*, Matschie ; *pelorhinus*, Matschie.

The type-specimens of Matschie's forms have been examined and found to agree with the red-nosed form of the Central Congo Basin. A more detailed account of the whole group is being prepared.

9. *Cercopithecus nictitans katangæ*, Lönnberg.

10. *Cercopithecus nictitans montanus*, Lorenz.

* Rev. Zool. Afr. iii. p. 121 (1919).

11. *Cercopithecus nictitans schmidti*, Matschie.

Syn.: *sassæ*, Matschie; *laimosæ*, Heller; (*schmidti*) *rutschuricus*, Lorenz; *orientalis*, Lönnberg.

There is a considerable amount of individual and biological variation in this form, which accounts for the great number of synonyms. This will be dealt with in a separate paper.

12. *Cercopithecus nictitans mpangæ*, Matschie.

Syn.: *enkamer*, Matschie; (*schmidti*) *ituriensis*, Lorenz.

IX. *Cercopithecus cephus*, Linnæus.

The two forms included under this heading have hitherto been regarded as separate species. They agree, however, in important characters of structure and marking. They both have the long fringe all around the ear, which has been well described by Dr. Allen, the broad nose-patch and black moustache on the upper lip, and, as regards coloration, the red tail and well-marked cheek-stripe. The main differences between the two appear to be, indeed, due to environment, as *erythrotis* is a mountain-form with deeper colour and longer denser fur.

In the skull the broad palate, curved tooth-rows, reduced metacone and hypocone of M^3 , and especially the shape of the mandible are characteristic of both *cephus* and *erythrotis*.

1. *Cercopithecus cephus cephus*, Linnæus.

Syn.: *cephodes*, Pocock; *inobservatus*, Elliot*; *pulcher*, Lorenz.

The type of *cephodes* (Brit. Mus. no. 80.6.7.3, ♂, subad., Gaboon, Laglaize coll.) is rather a dark specimen, both eumelanine and phaeomelanine being strongly developed. Tail unusually covered with black, the red being reduced in its favour. The whole, however, does not surpass the range of individual variation found in *cephus*. Normally coloured skins have been examined from the same general region.

C. pulcher, Elliot, does not seem to differ from ordinary *cephus*, which, apparently, was unknown to its author.

2. *Cercopithecus cephus erythrotis*, Waterhouse.

Syn.: *sclateri*, Pocock.

The type of *sclateri* is an immature male, originally kept

* Cf. Ann. & Mag. Nat. Hist. (9) xix. 1927, p. 153.

at the London Zoo and now in the British Museum (no. 17. 10. 15. 1). After careful comparison, I have no doubt that this is a specimen of *erythrotis* with the black pigment (eumelanine) somewhat reduced. The characters by which it differs from normal skins of that form are partly due to confinement, as is the strong development of the greenish hue and speckling, or merely individual, like the very yellow upper portion of the cheeks. The series from Victoria, S.W. Cameroons, in the Berlin Museum, shows a much wider range of variation. There is nothing to distinguish the Fernando Po from the continental specimens.

X. *Cercopithecus talapoin*, Schreber.

Since I. Geoffroy St. Hilaire's original description of *Miopithecus*, it has been asserted that there are only three cusps in the last lower molar, instead of the normal four of *Cercopithecus*. In 1925, Pocock* pointed out that this statement is wrong, and that there are four cusps in *M*^s in *talapoin*; he, accordingly, regarded *Miopithecus* as a synonym of *Cercopithecus*. It now appears that there was a *lapsus calami* in I. Geoffroy's original note, an error which he later copied himself without again looking at the specimen, and which was repeated by all subsequent revisers, who obviously simply followed their predecessors. The number of cusps is not reduced in the last lower, but in the last upper molar. In most of the skulls which I have seen there is only the metacone, the hypocone being absent or minute. There are, however, specimens in which it is normally developed. This character, therefore, does not appear to be of generic value, and the more so as in certain forms of the *C. aethiops* group (e. g., *C. a. arenarius* and even more so in *C. cephus*) there is tendency for a reduction of the hypocone. Apart from the small size there is really nothing essentially different in this species from typical *Cercopithecus*.

1. *Cercopithecus talapoin talapoin*, Schreber.

Syn.: *melarhinus*, G. Cuvier; *capillatus*, I. Geoffroy.

2. *Cercopithecus talapoin ansorgei*, Pocock.

3. *Cercopithecus talapoin pileletti*, Lönnberg.

* Ann. & Mag. Nat Hist. (9) xvi. 1925, p. 267, text-fig. A.

LXXXII.—*The Species of the Genus Cercocebus*,
E. Geoffroy. By ERNST SCHWARZ.

SINCE the first modern revision of this genus by Mr. Pocock* this group of monkeys has been revised by Elliot †, Allen ‡, and the *albigena*, *aterrimus*, and *galeritus* groups by the present author §. Since then a new genus, *Cercolophocebus*, Matschie, and several new species have been described by Matschie and v. Lorenz. A recent examination of a great series of specimens in various museums, including most of the type-specimens, has enabled the author to settle the status of all of the so-called species and to reduce the number of actual species to only four.

From its African allies of the genus *Cercopithecus* the Mangabeys are at once distinguished by the presence of a heel or fifth cusp in the last lower molar, by the pale eyelids, and by the fusion of the ischial callosities in the male. The absence of speckling is, as Pocock has pointed out, not a distinctive feature.

The species of *Cercocebus*, as they are now defined, readily fall into two groups distinguished both by external and cranial characters—*e. g.*, the *torquatus* and *albigena* groups, both of which may be divided into two species. Throughout the greater part of the range of the *C. albigena* section a species of the *C. torquatus* group occurs with it.

In the species of the *torquatus* section there is a tendency to speckling in the hairs, the pelage is short, or at most moderately long, and there is no trace of a crest. The skull is characterized by the convexity of the profile in the brain-case, the frontals being dome-shaped and distinctly set off from the supraorbital ridge, and the parietals strongly bent, the palate is almost rectangular in cross-section, the incisive foramina short and broad, and the carotic canal placed in the median half of the bulla. The cheek-teeth are swollen at the base, much broader than long, and usually there is no accessory cusplet inside the upper nor outside the lower molars ||.

* Ann. & Mag. Nat. Hist. (7) xviii. pp. 278-86 (1906).

† 'Review of the Primates,' ii. pp. 251-72 (1913).

‡ Bull. Am. Mus. Nat. Hist. xlvii. pp. 327-48 (1925).

§ Ann. & Mag. Nat. Hist. (8) v. pp. 527-30 (1910); Sb. nat. Fr. 1910, pp. 452-59 (1911).

|| This cusplet has been observed in a single skull of *C. t. torquatus* (Berlin Mus. A.63.09.26, from between the Ossa Lake and Sanaga River S.W. Cameroons).

In the *albigena* section the colour is mainly black, and there is no speckling whatsoever; the pelage is long and loose, and there is always a parietal or occipital crest. In the skull the profile is more evenly shaped and less convex, the palate is rounded in cross-section, the incisive foramina narrow and their roof poorly ossified behind, and the carotic canal in the middle or lateral portion of the bulla. The cheek-teeth are not swollen at the base, but there is an indication of a fold or an accessory cusplet inside M^1 and M^2 and outside M_1 and M_2 at the base of the teeth, between the main cusps.

I. *Cercocebus torquatus*, Kerr.

No whorl, but in one case (*torquatus*) a parting on vertex. A conspicuous cheek-beard, erected into a crest at the meeting of the upper and lower section, the hairs of which are directed downward and upward respectively. Vertex always brightly coloured or speckled, the crown-patch always defined by a black or white parieto-occipital band, which is continued behind into a neck-patch and gradually passes into the black spinal line which extends down to the tail; tail-tip paler than rest of tail. No speckling except in *C. t. atys*, where the crown-patch is speckled.

Skull with the nasals strongly convex.

Cercocebus torquatus atys, Audebert.

1797. *Simia Atys*, Audebert, Hist. Nat. Singes et Makis, fam. iv. sect. 2, p. 13, pl. viii. ("Indes Orientales").

1812. *Cercopithecus fuliginosus*, E. Geoffroy, Ann. Mus. Hist. Nat. Paris, xix. p. 97 (no locality) *.

This is the darkest form of the group, slaty grey above and pale grey below. The crown-patch is mixed olive and black, the temporal line and the parieto-occipital band black and the latter elongated into a black neck-patch. The sagittal line down the back not always sharply defined.

No whorl on vertex, occasionally a parting in the middle line of the crown. Check-beard long and prominent.

Face flesh-coloured, only nose, mouth, and chin blackish. Cheek-teeth slightly less swollen than in *C. t. torquatus*; breadth-length ratio of M^2 about 106.

Hab. French Guinea to Liberia.

The type of *Simia Atys* is still in the Paris Museum.

* Primarily based (and here fixed) upon "Le Mangabey," Buffon, Hist. Nat. xiv. p. 244, pl. xxxii.

Elliot has examined it, but thought it to be unidentifiable. On a recent visit to Paris, I have been able to see it by the kind permission of Prof. Bourdelle, and made the following notes :—

♂ juv.; Gallery No. 220; mounted specimens on exhibit; skull in specimen. "Afrique occidentale." Bourlet de la Vallée.

This is a perfect albino. The condition of the skin is fairly good, except that it is rather dusty, and that half of the tail is gone. Permanent incisors, but no permanent canines yet developed. The condition of the fur, more especially the long whiskers, leave no doubt that this is the species generally known as *Cercocebus fuliginosus*. Unfortunately, there seems to be no course but to replace it by Audebert's name, as the type-specimen is fully characteristic.

The type-specimen of *Cercopithecus fuliginosus* is no longer preserved at the Paris Museum.

Cercocebus torquatus lunulatus, Temminck.

1853. *Cercopithecus lunulatus*, Temminck, Esq. Zool. Guinée, p. 37 (Rio Boutry [Gold Coast]).

This form is in most respects similar to *C. t. athys*. The general colour is, however, paler, with a brownish hue, the lower surface, inside of limbs, and lower half of cheeks much lighter, whitish, and a sagittal line always clearly discernible. The crown-patch is blackish brown, not speckled, but its posterior portion shows a creamy crescentic zone. The whole delimitation of the crown-patch (parieto-occipital basal), the temporal line, and neck-patch are brownish black of the type found in *C. t. atys*.

Known at present with certainty only from the Gold Coast. The type-series, collected by Pel, is still in the Leiden Museum.

Cercocebus torquatus torquatus, Kerr.

1792. *Simia* [*Cercopithecus*] *athrops torquatus*, Kerr, Linnaeus, An. Kingd. p. 67*.

1843. *Cercocebus collaris*, Gray, List Mamm. B.M. p. 7 †.

Greyish brown to dark brown; lower surface paler, but

* Based on "Le Mangabey à collier blanc," Buffon, Hist. Nat. xiv. p. 244, pl. xxxiii.

† Primarily based upon Audebert's *Simia athrops*, var. *a* (Hist. Nat. Singes et Makis, fam. iv. p. 2, pl. x., and Buffon's "Mangabey à collier blanc," both of which are the same,

not whitish. Spinal line always present. Crown-patch chestnut-red, the individual hairs tipped with blackish. Temporal line, parieto-occipital band, and neck-patch white, also tail-tip. Lower portion of cheeks whitish, but a broad, dark brown cheek-line present.

Fur rather short; whiskers shortest in the western group. A slight parting on forehead.

This form is characterized by the short whiskers, the red crown, and white instead of black markings as in the allied forms. It is known from the Lower Niger to the Gaboon; its inland range remains to be ascertained.

II. *Cercocebus galeritus*, Peters.

A whorl or parting on vertex. Whiskers short, but of the general plan as in *torquatus*. No crown-patch nor temporal or parieto-occipital markings and no dorsal line, but upper side more or less speckled.

Skull with the nasals flat and broad.

Although clearly separable now, this group is obviously the eastern representative of the western big-toothed forms of the *torquatus* type.

Cercocebus galeritus chrysogaster, Lydekker.

1900. *Cercocebus chrysogaster*, Lydekker, Nov. Zool. vii. p. 279, pl. iii.
(Upper Congo).

General colour of upper side golden-brown speckled with black, giving a greenish general impression. Lower side and inside of limbs bright ochraceous orange. Outside of limbs darker than colour of backs, hands rather distinctly set off, blackish brown. No crown-patch nor parieto-occipital band. No whorl but a slight parting on forehead.

This is an extremely well-marked form, obviously closely related to *C. g. agilis*. Seven specimens are known to me, all from confinement and without locality. Five of them are skins and skulls now preserved at Lord Rothschild's Museum, Tring. A skull dated 25.12.25 is almost identical with a skull of *C. g. agilis*, Brit. Mus. No. 5.5.23.3, except for differences of sex. Two living specimens at Paris and Antwerp have also been examined. From *C. g. agilis* this form is at once distinguished by the absence of the whorl on the crown, the prevalence of ochre in the colour of the back, and the bright orange lower side. As *C. g. agilis* has been shown to occur in the whole region north of the

Congo, it is highly probable that the home of *C. g. chrysogaster* is the southern and central Congo basin, south of the river itself*.

Cercocebus galeritus agilis, E. Rivière.

1886. *Cercocebus agilis*, E. Rivière, Rev. Scient. (3) xii. p. 15 (French Congo).
 1900. *Cercocebus hagenbecki*, Lydekker, Nov. Zool. vii. p. 594, pl. iii. (Upper Ubangi River).
 1914. *Cercocebus fumosus*, Matschie, Sb. Nat. Fr. p. 341 (N.W. of Beni [Semliki]).
 1915. *Cercocebus oberlaenderi*, Lorenz, Anz. Ak. Wiss. Wien, Math. Nat. Kl. lii. p. 172 (Mawambi [Ituri River]).

Pelage fairly short; a distinct whorl on forehead. Whiskers very short.

Colour of upper side dark greyish brown strongly speckled with gold-yellow, especially on the fore parts, arms, and thighs, and particularly on the crown. Flanks, lower legs scarcely speckled. Cheeks slightly speckled and with an indication of a dark cheek-line. No temporal nor parieto-occipital markings. Under surface whitish, soiled with dirty brown.

Among the normally coloured specimens there are some which are, quite irrespective of locality, much paler and correspond to the type which has been called *hagenbecki* and *fumosus*. One of the original specimens of *agilis* in the Paris Museum is of this type (Cat. Gén. No. 1886-126).

The range of *C. g. agilis* includes the whole of the forest-country north of the Congo from the Ituri Forest in the east to the Cameroons. A young specimen in the British Museum from Ekun'ouru, Oban, S. Nigeria (9.6.22.1, P. A. Talbot coll.), shows the overlapping of its range with that of *C. torquatus torquatus*.

The type of *hagenbecki* is a ♂ specimen, now at Tring. It was kept alive at the London Zoo from October 16, 1900, to April 5, 1901.

Cercocebus galeritus galeritus, Peters.

1879. *Cercocebus galeritus*, Peters, Mb. Ak. Berlin, p. 830, Taf. in. iii. (Mitole [mouth of Osi and Tana Rivers, Kenya]).

This conspicuous form, characterized at once by the whorl

* Since the above was written this assumption has been corroborated. With the kind help of Dr. Mouquet, of the Jardin des Plantes, the locality of the living specimen at Paris has been ascertained as Irobu, north of Lake Tamba; also a freshly killed specimen from Oshwe, Lukenie River (no. 9404, Dr. Ghesquière coll.), has recently been received at the Congo Museum, Tervueren.

and toupet on the vertex, is closely allied to *C. g. agilis*. The skull, although much smaller, is distinctly of the *agilis* type, the size and shape of the cheek-teeth above all being quite unmistakable. Except the type at Berlin, two new specimens have been examined in the British Museum, agreeing in all particulars with the original specimens. The female is slightly paler. They were collected, as the type, on the Tana River, Kenya Colony, by Capt. Caldwell.

III. *Cercocebus albigena*, Gray.

The characters of this group and of *C. aterrimus* have been explained many years ago*. It is therefore not necessary to repeat them in detail.

Cercocebus albigena albigena, Gray.

1850. *Presbytis albigena*, Gray, P. Z. S. p. 77, pl. xvi. (W. Africa).

The characters of this rare species have been described in the paper cited above. The type-locality was assumed to be the Lower Congo and Gaboon. A series of skins from S.W. Cameroons is much like the type. Until further specimens from the Gaboon and Lower Congo have been examined, the status of typical *albigena* cannot satisfactorily be settled.

Cercocebus albigena zenkeri, Schwarz.

1910. *Cercocebus albigena zenkeri*, Schwarz, Sb. Nat. Fr. p. 456 (Bipindi [Lokundje River, Cameroons]).
 1913. *Cercocebus (Leptocebus) albigena weynsi*, Matschie, Rev. Zool. Afr. ii. p. 211 (Sanga River [French Congo]).

The type-specimen of *weynsi* in the Congo Museum, Tervueren, has the pale cheeks and mantle, and is undistinguishable from *zenkeri*.

Cercocebus albigena johnstoni, Lydekker.

1900. *Semnocebus albigena johnstoni*, Lydekker, Nov. Zool. vii. p. 594 ("near Lake Tanganyika") †.
 1906. *Cercocebus Jamrachii*, Pocock, Ann. & Mag. Nat. Hist. (7) xviii. p. 454, pl. xi. (Molinga [Lake Mweru]).
 1913. *Cercocebus (Leptocebus) albigena ituricus*, Matschie, Rev. Zool. Afr. ii. p. 208 (between Beni and Irumu [Semliki-Ituri Forest]).

* Ann. & Mag. Nat. Hist. (8) v. pp. 527-30 (1910).

† Probably from the Semliki or Ituri Forest (Lorenz, l. c. p. 233).

1913. *Cercocebus albigena ugandæ*, Matschie, l. c. p. 210 (Chagwe [Uganda]).
 1917. *C[ercocebus] albigena mawambicus*, Lorenz, Ann. Naturh. Hofmus. Wien, xxxi. p. 233 (Mawaubi [Ituri River]).

I have recently again examined the type-specimens of Matschie's races, but cannot find any character of more than individual value. There is no doubt, in my opinion now, as in 1910, that the specimens we both studied are the same, and are representative of *C. a. johnstoni*. Additional material in the British and Tervueren Museums only confirms this result. No specimen has ever been brought from a district as far south as the type of *janrachi*; it is not improbable that the living specimen was brought from further north.

IV. *Cercocebus aterrimus*, Oudemans.

1890. *Cercopithecus aterrimus*, Oudemans, Zool. Gart. xxxi. p. 267 (Stanley Falls).
 1899. *Cercocebus congieus*, Selater, P. Z. S. p. 827, text-fig. (Stanley Falls).
 1900. *Sennocebus albigena rothschildi*, Lydekker, Nov. Zool. vii. p. 595, pl. (no locality).
 1906. *Cercocebus Hamlyni*, Pocock, Ann. & Mag. Nat. Hist. (7) xviii. p. 208, pl. vii. ("Upper Congo").
 1914. *Cercolophocebus cælognathus*, Matschie, Sb. Nat. Fr. p. 342 (Kindu [Lualaba River, Upper Congo]).

The external characters of this species have been amply discussed elsewhere. The skull shows the essential characters of *C. albigena*, including the accessory cusp in the molars, but is distinguished at once by the flatter facial fossæ. The type of "*Cercolophocebus cælognathus*" is an adolescent female with the M^3 still in the gums, and one of the two specimens upon which my description of the skull of *C. aterrimus* was based. Additional material, mostly in the Congo Museum, Tervueren, shows this form to inhabit the whole of the forest-area south of the Congo, but not north nor east of the great river. All the specimens received from "Stanley Falls" are obviously from the left bank.

C. aterrimus is well separated from *C. albigena*, but obviously closely allied. It is represented in the country north and east of the upper and middle Congo by *C. albigena johnstoni*.

LXXXIII.—*Coleoptera (Heteromera, Terebralia, Malacodermata, and Bruchidae) from the Galapagos Islands, collected on the 'St. George' Expedition, 1924.* By K. G. BLAIR, B.Sc., F.E.S.

THE insects of the Galapagos Islands are of peculiar interest not only on account of the isolated position and long separation of the archipelago but also on account of the detailed study that has already been given to them. In the most recent account of the Coleoptera of the islands ('Zoologica,' New York, v. 1924 (Jan. 1925), part 20) Mr. A. J. Mutchler gives an excellent summary of all previous work upon the Coleopterous fauna, with a full bibliography, so that it is unnecessary to repeat this here†.

That the beetle fauna is as yet by no means fully known is evidenced by the fact that of the material now before me nine out of the sixteen species have not previously been recorded from the Galapagos Islands. Of these six belong to two families, Anobiidae and Bruchidae, not hitherto known to be represented in the archipelago. It will be noticed that at least four‡ of these newly recorded species were collected at light, an ordinary "mothing" screen illuminated by a powerful light having been set up ashore nearly every evening. Further evidence of the incompleteness of our knowledge of this fauna is found in the brief note quoted by Mutchler on the results of the expedition of the California Academy of Science, which remained, I believe, for a full year in the islands, obtaining 150 species of beetles, a number more than twice as great as that of all the other collections combined. It is much to be regretted that this rich collection has never been worked out in detail.

As no doubt the time of year at which the various collections were made might be expected to have some bearing upon the results obtained, the table given below may be of interest. Unfortunately, however, we have no information regarding the period between the middle of October and the end of March. It will be evident, however, from the table that much of the success of the 'St. George' Expedition, which fell within the season of Dr. Baur's visit in 1891,

† To this list of the Coleoptera must be added the triungulin larva provisionally assigned to *Cissites (Horia) maculata*, Swed., described by C. T. Brues from the same expedition (*ibid.* part 11).

‡ Mr. Collenette thinks that other species, concerning which he has no note, were also captured by this method.

was due to the utilisation of light as a means of attraction, a method which does not appear to have been adopted by any of the earlier expeditions.

To Mr. C. L. Collenette, to whose exertions the present collection is due, I have to express my thanks for much help in the preparation of this paper.

Family Tenebrionidæ.

† *Stomion galapagoense*, G. R. Waterhouse, Ann. & Mag. Nat. Hist. xvi. 1845, p. 29.

Charles Is., numerous examples under stones, sea-level.

Previously recorded from Chatham Is. by Linell, and a single specimen in April from South Seymour by Mutchler. It had been previously collected in Charles Is. by Commander Cookson of H.M.S. 'Peterel' in 1875.

Stomion lævigatum, G. R. Waterhouse, l. c. p. 30.

Indefatigable Is., 3 ex. under stone at sea-level; Charles Is., 2 ex. at light; Albemarle Is., 1 ex. at light.

Mutchler records it from Daphne Major and Tower Islands in April.

Ammophorus obscurus, G. R. Waterhouse, l. c. p. 32.

Indefatigable Is., 1 ex. under stone, sea-level.

Recorded by Mutchler in numbers from Daphne Major in April under stones at the bottom of the crater. The single individual referred to this species differs from typical specimens in having the thorax more densely and finely punctate, and when further material is available may prove to be of a distinct species or race.

† "Insects were difficult to obtain, as many species were aestivating, lying up in snug retreats, until the wet season (or, perhaps one should say, the season less dry than the one the island was experiencing) should call them to activity again. One species of beetle was extraordinarily numerous under pieces of lava. These loose blocks covered the ground, two or three to the square yard, and wherever we went, near the shore or on the slopes of the small craters inland, we found the beetles under almost every one. There must have been many millions. A large proportion were dead, and as the living ones were very sluggish it was not easy to separate them. There was no evidence of disease to account for the casualties, but under shelter in that dry climate their chitinous bodies would resist decay for months and perhaps years."—C. L. Collenette, 'Sea-girt Jungles', p. 87.

Family *Ædemeridæ*.

Oxaxis galapagoensis, Linell, Proc. U.S. Nat. Mus. xxi. 1898, p. 266.

James Is., 23 ex. (type-locality, Chatham Is.).

The species is compared by its describer with the N. American *Alloxaxis dorsalis*, Melsh., but is much more nearly related to *O. litoralis*, Champion, from Guatemala and Panama, if, indeed, it is really distinct from that species. The punctures of the thorax are relatively large and coarse, very much coarser than those of the elytra, the pubescence is consequently scanty and is directed mainly backwards. In *A. dorsalis* the thoracic puncturation is very fine, scarcely coarser than that of the elytra, and the pubescence denser and directed forwards. From *O. litoralis*, which in sculpture is identical, it differs in its slightly broader thorax and in the outer dark area of the elytra being more extensive, frequently uniting with the small scutellar patch and leaving only a narrow sutural band testaceous.

**Oxaxis pilosa*, Champion, Biol. Centr.-Amer., Col. iv. 2, 1890, p. 156, pl. vii. fig. 15.

James Is., 1 ex. (Type-locality, Guatemala.)

Differs from the last species in its more uniform brownish coloration, long, rather shaggy pubescence, which, however, is similarly inclined on the thorax, distinct elytral costæ, and in the much greater distance separating the eyes on the under side of the head. In the present species this distance is about twice the width of the mentum; in *O. galapagoensis* about equal to the width of the mentum. The tip of the right mandible is concealed; on the left mandible some distance from the apex there is a slight tooth beneath.

**Alloxaxis collenettei*, sp. n.

Brownish testaceous, moderately densely clothed with pale decumbent pubescence. Head somewhat infusate between eyes, moderately densely and finely pubescent. Antennæ extending beyond middle of elytra, second joint about one-third as long as third, last joint constricted in middle. Right mandible with a subapical tooth above; last joint of

* Indicates species additional to the known fauna of the Galapagos Islands.

maxillary palpi elongate, apex oblique, rather shorter than inner side. Thorax widest near front, with a broad transverse depression behind anterior margin and a smaller depression before base; surface closely and finely punctate, pubescence moderately dense and directed forward. Elytra obviously wider than thorax, subparallel, each with the suture and four rather broad costæ distinctly raised, the costæ more or less sharply limited by a fine depressed line on each side, the costæ and the intervals subequal; the surface, both of costæ and intervals rather dull, alutaceous, with scattered granules, each of which bears a moderately long, backward sloping seta; this pubescence distinctly coarser and sparser than that of the thorax.

Length 6-11 mm. (average about 8 mm.).

James Is.; (type) Indefatigable, Charles, and Albemarle Is.; mostly at light.

Closely allied to *A. seymourensis*, Mutchler, which indeed I thought that it might be, but Mr. Mutchler has very kindly compared a specimen with his type and notes the following differences: head in *seymourensis* shining and devoid of pubescence; thorax with pubescence lying similarly forward, but very short and sparse; elytra with practically no traces of impressed striæ, and the pubescence somewhat short and sparse.

Of the Central American species it most closely resembles *Oxacis lineatula*, Champ., but is not very closely allied, for the latter has no tooth near apex of right mandible, and the last joint of the maxillary palpi more elongate, with the inner edge very short.

The series before me exhibits considerable variation, some individuals having a more or less sharp depression on each side of the disc of the thorax before the middle; some have the suture and lateral margin, and some even the costæ, paler than the rest of the elytra. The sexes are not easy to distinguish unless the genitalia are exposed, though the males have rather longer antennæ and the fifth ventral segment of the abdomen subtruncate at the apex.

Family Bostrichidæ.

Amphicerus cornutus, Pallas, subsp. *galapaganus*, Lesue, Bull Mus. Paris, 1910, p. 184.

Apate sp., G. R. Waterhouse, Ann. & Mag. Nat. Hist. xvi. 1845, p. 36.

Bostrichus uncinatus, Germ., C. O. Waterhouse, Proc. Zool. Soc. London, 1877, p. 82.

Amphicerus punctipennis, Lec., Linell, Proc. Nat. Mus. Washington, xxi. 1899, p. 256.

Charles Is., 5 ex.; Albemarle Is., Tagus Cove, 1 ♂; all at light.

Collected by Charles Darwin on Chatham Is. on the dead branches of a mimosa tree.

Tetrapriocera tridens, Fabricius, Ent. Syst. i. (2) 1792, p. 362; Lesne, Ann. Soc. Ent. France, 1900, p. 483.

Tetrapriocera longicornis, Oliv., Linell, Proc. Nat. Mus. Washington xxi. 1899, p. 256.

Charles Is., at light, 1 ex.

Family Anobiidæ.

**Trichodesma denticollis*, sp. n.

Oblong, pitchy brown, covered with a moderately dense, subdepressed, irregularly lying, grey pubescence, with which are intermingled longer erect hairs. Thorax slightly transverse, widest about the middle, where it forms a stout projecting angle on each side; behind this angle the sides are somewhat excised, sinuate, with posterior angles completely rounded; disc strongly gibbous behind the middle, the front of the gibbosity feebly sulcate, the sulcus not reaching the anterior border, with a pair of elongate black patches of hair on the anterior summit of the gibbosity, and a pair of similar but smaller patches in front of them. Elytra rather irregularly punctate, the pubescence of mixed grey and brown hairs, the absence of brown hairs in certain areas forming indistinct pale markings—*i. e.*, a patch across the base, a median zigzag band, and an apical patch; further, there are one or two small patches of dark hair on the edge of the basal and apical pale patches.

Length 6 mm.

Charles Is. (type) and Indefatigable Is., 1 ex. at light from each locality.

More closely resembles *T. pulchella*, Schaeff., from Texas, than any of the Central American species of Gorham, agreeing with it in the irregular elytral puncturation and in the pattern formed by the pubescence, except that this pattern is very much less distinct, and the median pale band is expanded both ways along the suture. It differs, however, in the strongly angulate sides of the thorax.

**Thaptor galapagoensis*, sp. n.

Oblong, pitchy-brown, subopaque, covered with a short, moderately dense, decumbent pubescence. Head concealed from above by the projecting thorax; the latter about twice as wide as its median length, anterior and posterior margins broadly lobed in the middle; anterior angles acute, deflexed; posterior angles rounded; surface moderately densely punctate, the intervals between the punctures densely punctulate. Elytra wider than the thorax, about twice as long as wide, sides subparallel, the three outermost striae sharply defined, the two external deeply impressed in the posterior half, the other striae represented by rows of large punctures, epipleural lobe with an abbreviated, oblique, median stria; intervals slightly convex, especially towards the sides, punctured like the thorax, the larger punctures not as big as those of the striae.

Length $3\frac{1}{2}$ – $5\frac{1}{2}$ mm.

Charles Is. (type), James Is., Albemarle Is., at light.

Resembles *T. pupatus*, Gorh., from Guatemala, but more opaque, much more strongly sculptured, and with a greater development of the elytral striae. From the Chilean *Calymnoderus capucinus*, Sol., it differs further in not having any pronotal hood, the anterior lobe not breaking the general convexity of the thorax.

**Eupactus georgicus*, sp. n.

Ovate, very convex, glabrous, black or pitchy black. Head briefly carinate on vertex. Thorax with anterior and basal margins sinuate, posterior angles very obtuse, disc finely and remotely punctate, not more strongly so towards the sides, punctures round. Elytra with a broad shallow submarginal impression behind the epipleural lobes, finely, irregularly, and rather sparsely punctate, punctures a little finer than those of thorax, elongate. Abdomen sparsely punctate, punctures not coarser or more numerous towards the sides of the segment. Last ventral segment with a deep marginal groove interrupted in the middle.

Length $2\frac{1}{2}$ mm.

Charles Is., 1 ex. beaten from vegetation.

Must be closely allied to the North American *E. nitidus*, Lec., from which it differs in the elongate elytral punctures, and in the sparser, more even puncturation of the underside.

**Eupactus alutaceus*, sp. n.

Ovate, very convex, very finely, sparingly, and inconspicuously pubescent, testaceous, with the elytra pitchy. Head briefly carinate on vertex; thorax very finely and sparingly punctate, each puncture bearing a short fine erect seta, the space between them finely reticulate or alutaceous. Elytra with submarginal impression on posterior third only; sculpture like that of thorax. Underside similarly punctured to dorsal surface, but punctures and pubescence denser towards sides and apex; last ventral segment with deep marginal groove interrupted in middle.

Length $2\frac{1}{4}$ mm.

James Is., 1 ex. in rotten wood.

Resembles the Mexican *E. semirufus*, Champ., in colour, but differs entirely in sculpture. The surface is obviously less nitid than that of *E. georgicus*, but a fairly high magnification ($\times 60$) is required to bring out the reticulation and the fine hairs.

Family Cleridæ.

**Pelonium longfieldæ*, sp. n.

Elongate, slightly tapering from behind forwards, pubescent, brownish testaceous, with the front of the head, the knees, and the tarsi black, the elytral margins and the rest of the legs paler. Head densely punctate, eyes large, prominent, more or less approximate; antennæ 11-jointed, the last three joints expanded, sexually dimorphic. Thorax slightly longer than wide, strongly attenuate just before base, densely and rather coarsely punctate; disc infusate to a variable degree, the dark spot sometimes medially divided. Elytra somewhat expanded behind middle, irregularly punctate, punctures on basal half large and deep with the interspaces finely punctate, posteriorly uniformly finely punctate, the transition between the two types of puncturation gradual. Abdomen beneath infusate, the posterior margin of each segment and a small spot on each side yellow; puncturation moderately fine, not very dense, the yellow segmental margins impunctate.

♂. The first two joints of the antennal club divided below the middle, the free branch rather longer and thicker than the main branch; fifth ventral segment emarginate at apex, leaving sixth prominent.

♀. First two joints of antennal club expanded into a

broad triangular lobe on inner side, not including the apex, and projecting a little forward of it, about as long as apical width; fifth ventral segment of abdomen broadly rounded.

Length 10-11 mm.

Charles Is., James Is., Indefatigable Is., and Albemarle Is. (Tagus Cove), both sexes at light.

Very close to, and perhaps only a variety of, *P. luridum*, Gorb., from Panama, but darker in colour and more coarsely punctate. In *P. luridum* the first two joints of the antennal club are more elongate, distinctly longer than their apical width. The four specimens in the British Museum are all ♀. It is rather strange that this species, apparently not uncommon on all the islands, should not have been found by the earlier collectors.

I have pleasure in naming this species after Miss C. E. Longfield, to whose able assistance in the field many of Mr. Collenette's captures were due.

Necrobia rufipes, de Geer, Mem. v. 1775, p. 165, pl. xv. fig. 4 (*Clerus*).

An insect of cosmopolitan distribution, being carried everywhere by commerce. Commonly known as the "copra" beetle, from its abundance in the vicinity of this commodity, it frequents stored merchandise in great variety, in many cases being probably a predator on other insect-pests present, though in others the larva appears to feed upon the particular product in question.

Family Bruchidæ.

**Spermophagus galapagoensis*, sp. n.

Ovate, reddish or brownish testaceous, clothed with a moderately dense pale pubescence, that of the elytra maculate. Eyes prominent; thorax about twice as wide as long, sides slightly rounded, anterior angles subrectangular, but deflexed and invisible from above, posterior angles somewhat obtuse; disc finely and moderately sparsely punctate, the interstices finely and densely punctulate. Scutellum about twice as long as wide, parallel-sided. Elytra widest behind the middle, the sides gradually rounded, the striae fine and cleanly cut, the punctures in them small, not encroaching upon the intervals, not very obvious, first stria abbreviated at apex of scutellum; intervals feebly convex, finely and densely punctulate with a few larger punctures near apex; the pubescence forms numerous small, not very sharply

defined pale spots, a little more elevated than the darker intermediate spaces, these spots not conspicuously more evident on the alternate interstices; the derm of elytra beneath the pubescence also maculate or tessellated, the lighter patches bearing the lighter pubescence; pygidium subtriangular, rounded at apex, puncturation very similar to that of thorax.

Length 4 mm.

Albemarle Is., Tagus Cove, 2 ex., the smaller, redder one lacking the head and thorax.

Allied to *S. hoffmannseggii*, Gyll., or, still more nearly to *S. togatus*, Sharp, from Guatemala, from which it differs in the more deeply cut elytral striæ with punctures scarcely evident, and in the finer and more even maculation; in *S. togatus* the pale spots are much longer, and confined to the alternate interstices; in this species also the second and third intervals are depressed along the disc leaving the sutural interval evidently raised, whereas in *S. galapagoensis* the transverse convexity is unbroken.

. **Bruchius fuscomaculatus*, sp. n.

Shortly ovate, fuscous, clothed with a rather dense grey pubescence, with fuscous spots on elytra; legs red. Antennæ fuscous, short, compact, gradually thickened to apex; thorax with basal median lobe broadly truncate, lateral sinuations sharp. Elytral striæ cleanly cut, with punctures scarcely evident; intervals, except the first which is very narrow, flat and even; fifth interval tuberculate at base; the fuscous spots are situated as follows:—on the humerus, rather large and produced backwards; a small spot on fourth interval a little behind the base; a larger spot on third interval a little behind middle; a larger spot on eighth and ninth intervals a little anterior to the last; the apex, rather broadly, with a few enclosed pale spots; in addition to these, each interval except the first has a series of minute dark dots rather widely spaced. Legs red, with terminal joint of tarsi fuscous; posterior femora armed with one sharp tooth beneath, with two denticles behind it; posterior tibial spur about as long as apical width of tibiae.

Length $2\frac{1}{2}$ mm.

James Is., 1 ex. swept from vegetation.

Allied to the cosmopolitan *B. obtectus*, Say, or, more nearly, to *B. puellus*, Sharp, from Panama, in which the fifth elytral interval is not tuberculate at base, the striæ are wider, more obviously punctate, and the intervals lack the

series of minute spots. *B. obtectus*, though it has the series of minute spots on the intervals, lacks the tubercle at the base of the fifth interval, has the striæ much more coarsely punctate, the posterior femora largely black at base, and the tibial spur less than half as long as the apical width of the tibia.

Table showing Species captured by the different Expeditions to the Galapagos Islands.

	Darwin, 5. ix.-20. x. 1835.	Frig. 'Eugenie,' 11-20. v. 1852.	H.M.S. 'Peterel,' vi. 1875.	S.S. 'Albatross,' 5-11. iv. 1888.	S.S. 'Albatross,' 28. iii.-4. iv. 1891.	Dr. Baur, 9. vi.-6. ix. 1891.	Williams Exp. iv. 1923.	'St. George,' 24. vii.-8. viii. 1924.
<i>Stomion galapagoense</i>	+	..	+	+	..	+	+	+
— <i>bauri</i>	+	+	..	+
— <i>helopioides</i>	+	+
— <i>lævigatum</i>	+	+	+
<i>Ammophorus galapagoensis</i> ..	+
— <i>bifoveatus</i>	+	+
— <i>cooksoni</i>	+
— (<i>? = caroli</i>)	+
— <i>obscurus</i>	+	+	+	+
<i>Pedonæces galapagoensis</i> ..	+
— <i>costatus</i>	+
— <i>morio</i>	+
— <i>pubescens</i>	+	+	..
— <i>bauri</i>	+
<i>Gnathocerus cornutus</i>	+
<i>Phaleria manicata</i>	+
<i>Lobopoda galapagoensis</i>	+
<i>Cissites maculata</i> (?)	+	..
<i>Oxaxis galapagoensis</i>	+	..	+
— <i>pilosa</i>	+
<i>Alloxaxis seymourensis</i>	+	..
— <i>collenettei</i>	+
<i>Tetrapriocera tridens</i>	+	+
<i>Amphicerus galapaganus</i> ..	+	+	..	+
<i>Trichodesma denticollis</i>	+
<i>Thaptor galapagoensis</i>	+
<i>Eupactus georgicus</i>	+
— <i>alutaceus</i>	+
<i>Pelonium longfieldæ</i>	+
<i>Necrobis rufipes</i>	+	+	+
<i>Sphermophagus galapagoensis</i>	+
<i>Bruchus fuscomaculatus</i>	+

l. signifies captured at light. Names in italics are those of species described as new.

LXXXIV.—*Some Nematocerous Diptera from Yunnan and Tibet.* By F. W. EDWARDS.

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[Plate XIX.]

THE present paper is a combined report upon a considerable amount of material of Nematocerous Diptera in the British Museum collections from Tibet and from high altitudes in adjacent territories. This material was derived from a number of different sources:—(1) A comparatively small number of specimens existing in the National Collection previous to 1922, and obtained by Messrs. A. E. Hobson, H. L. Walton, and others. (2) A collection made by Prof. J. W. Gregory in 1922 in the mountains of northern Yunnan, not far from the Tibetan borders. (3) The collection of the 1924 Everest Expedition, made by Major R. W. G. Hingston; this collection included, in addition to Tibetan material, a number of specimens taken on the journey through Sikkim—as most of these belong to known species, and are to be regarded as part of the fauna of the Himalayan foot-hills, they have not been discussed here. (4) One species collected by Mr. F. Kingdon Ward in south-east Tibet in 1924. (5) Tibetan material received during the last two years from Lt.-Col. F. M. Bailey, political officer for Sikkim, Bhutan, and Tibet.

As might have been anticipated from the paucity of information previously available regarding the Nematocerous fauna of this region, most of the specimens appear to belong to undescribed species. This is especially noteworthy in regard to the genus *Tipula*, of which I have found it necessary to describe no fewer than twenty species as new. In attempting to determine these I have examined material of nearly all the Indian species described by Brunetti, and have studied the descriptions of close on a hundred Oriental and Eastern Palearctic species published by Alexander, but in only a very few cases was a name discovered which could apply to the species before me. It is clear that the genus *Tipula* must attain a vast development, amounting probably to many hundreds of species, in the mountains of Asia.

The most interesting insects in these collections are those which show evidence of adaptation to life at high altitudes. Very few can be claimed as falling in this category. Two species (*Penthetria pilosa* and *Chironomus* sp.) show a marked increase in hairiness, such as occurs in various other groups of animals in this region. Two species of *Tipula* (*T. scandens* and *T. tardigrada*) show a reduction of the wings in the female sex, this also being the case in a few other species of *Tipula* of high mountain regions.

From a zoo-geographical point of view the most interesting
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fact is perhaps the occurrence of a Scandinavian species (*Syn-diamesa pubitarsis*) at a height of 17,000 ft. on Mt. Everest. The general conclusion seems indicated that up to 10,000 or 12,000 ft. the fauna is almost purely Oriental in type, but above this altitude there is a definite admixture of Palæarctic species.

Mycetophilidæ.

Several species of this family, referable to the genera *Macrocera*, *Erechia*, *Rhymosia*, etc., were obtained by Lt.-Col. Bailey in the Chumbi Valley. These will be discussed in a future paper.

Bibionidæ.

Crapitula motschulskii, Gimm.

TIBET: Rongshar Valley, 11,000–12,000 ft., 27–30. vi. 1924, 3 ♂ (*Major R. W. G. Hingston*). N. CHINA: Kalgan, 2 ♀ (collector unknown).

The males before me agree with Gimmerthal's description in having the reddish colour of the thorax extending forwards at the sides almost as far as the shoulders, and in having the last antennal segment small and rounded. They further agree as regards venation with the figure given by Loew (Berl. Ent. Zeitschr. ii. p. 106, 1858); cell M_1 is shortly stalked and cell Cu_2 widely open. But, whereas Gimmerthal figures the hind tibiae and tarsi as slender, and describes the legs as simple, the Tibetan males have the tip of the hind tibia and the first segment of the hind tarsus considerably swollen. In these specimens the claspers are curved almost into a semicircle, the tip being rather blunt.

The genus *Crapitula*, founded upon the present species, is extremely close to *Penthetria*, differing chiefly in the position of $r-m$, which is placed beyond two-thirds of the length of R_s in the former, before this point in the latter. Brunetti distinguished *Crapitula* (= *Pleciomyia*) by the sessile cell M_1 , but this is not constant.

Crapitula japonica (Wied.).

YUNNAN: N. of Chi-Tien, Yang-tse-kiang, 7000–8000 ft., 3. viii. 1922, 5 ♂ (*Prof. J. W. Gregory*).

This is the common Oriental species, which has frequently been recorded by Brunetti and other writers as *Crapitula melanaspis*, and of which *C. motschulskii* has been regarded as a synonym. I now believe, however, that all three are distinct species.

C. japonica, Wied. (*ignicollis*, Walk.), is represented in the British Museum by a long series of specimens from Simla, Darjiling, Khasia Hills, Canton, Yokohama, and elsewhere. A study of this series shows that the following characters differentiate the species from *C. motschulskii*:—Size larger; antennæ of ♂ shorter, but the last (twelfth) segment longer, being almost twice as long as broad; red area of præscutum not nearly reaching

shoulders at sides; male claspers equally strongly curved, but more pointed at tip; wings more uniformly blackish, cell M_1 sessile, cell Cu_2 either closed or very narrowly open; tip of hind tibia and first segment of hind tarsus much swollen.

It should be noted that Wiedemann, in describing this species, mentioned the manuscript generic name *Threneste*, stating that it differed slightly from *Penthetria* in venation. Should this be regarded as a valid publication of a new generic name, *Threneste* would have to replace *Crapitula*.

Crapitula melanaspis (Wied.).

I have before me a male from Java, which is evidently the true *C. melanaspis*. It shows the following features:—Antennæ as in *C. japonica*. Black area on front of mesonotum produced backwards in a rather sharp point to within a short distance of the scutellum (a condition which justifies Wiedemann's description of the thorax as having two reddish lateral patches, confluent in front of the scutellum). Neither tip of hind tibia nor first segment of hind tarsus noticeably enlarged. Claspers much less curved than in the other species, more slender and much more sharply pointed. Wings as in *C. japonica*, except that cell Cu_2 is a little more widely open.

Penthetria pilosa, sp. n.

♀. Body wholly black. Head clothed with long black hair, more densely on under surface. Pubescence of eyes long and dense, longer even than diameter of eye. Antennæ 12-segmented, last segment rounded, about half diameter of penultimate. Thorax and abdomen conspicuously and rather densely clothed with black hair, rather shorter than that of the head. Legs entirely black; front and middle femora with long black hair. Wings dark grey; costal cell blackish; stigma deep black. R_4 about half as long as R_5 ; $r-m$ placed at or just before two-thirds of the length of R_5 . Halteres black. —

Length of body 11 mm.; wing 13 mm.

TIBET: Chumbi Valley, 11,000 ft., 2. iv. 1924, type ♀. Jelap La, 12,000 ft., 1. iv. 1924, 1 ♀ (Major R. W. G. Hingston).

Very distinct from all other known members of the genera *Penthetria* and *Plecia* by the extremely long hair on the eyes; in other species the hairs are scantier, and only about as long as 2-4 facets. *P. pilosa* superficially resembles *Bibio obscuripennis*, de Meij.

Bibio consanguineus, Lw.

YUNNAN: Near Lonsha, 7200 ft., 31. vii. 1922, 2 ♀ (Prof. J. W. Gregory). TIBET: 16,000 ft., 1 ♂ (no exact data).

The male from Tibet agrees with the specimen from Ochotsk, mentioned by Loew as a variety; the females are typical.

Bibio nigriventris, Hal.

TIBET: Rongshar Valley, 13,000 ft., 1. vii. 1924, 1 ♂ (*Major R. W. G. Hingston*).

The hind tibiæ are slightly more swollen than in British examples of the species, but no other differences are apparent. Specimens have also been received from Mr. F. J. Mitchell, taken at high altitudes in Kashmir.

Culicidæ.

No mosquitoes were represented in the Mount Everest collections, but the following were obtained by Lt.-Col. Bailey in the Chumbi Valley, at about 10,000 ft.:—*Anopheles gigas*, var. *simlensis*, James; *Culex mimeticus*, Noé; *Aedes* (*Finlaya*) *pulchri-venter*, Giles; *Aedes* (*Aedimorphus*) *vexans*, Mg. The first two were found living together in the same pool. *Aedes vexans* was also found by Prof. Gregory in Yunnan (Gadzu Be-t'a, 23. vii. 1922).

Chironomidæ.

Syndiamesa pubitarsis, Zett.

TIBET: Rongbuk, 17,000 ft., 23. v. 1924, 1 ♂, 1 ♀, "over pools of clear water on glacier" (*Major R. W. G. Hingston*).

The male claspers are rather broader than in Scandinavian specimens, but there can be no doubt of the specific identity.

Diamesa sp.

TIBET: Rongbuk, 16,500 ft., 22. v. 1924, 1 ♀ (*Major R. W. G. Hingston*).

Similar to the European *D. walli*, Mg., but antennæ rather longer, last segment not at all swollen; wings rather milky by reflected light.

Chironomus sp.

TIBET: Tinki Dzong, 14,500 ft., 1. v. 1924, 2 ♀ (*Major R. W. G. Hingston*).

A rather large black species with blackish halteres, very much resembling the European *C. pilicornis*, Fab., but antennæ with more numerous hairs in verticils, and first segment of front tarsi distinctly longer than the tibia (1.2:1).

Tipulidæ.

Tipula gregoryi, sp. n.

♀. *Head* brownish grey, with indications of a darker median line. A black spot immediately above the root of each antenna. Front a little over half as broad as one eye; frontal tubercle prominent and slightly bifid. Rostrum ochreous above, dark brown at sides and beneath; nasus rather long. Antennæ with the scape

ochreous, flagellum dark brown; verticils long; palpi blackish. *Thorax* chocolate-brown above, darker towards sides of præscutum and scutum; pronotum ochreous at sides; præscutum with an indistinct pale central line, and indications of four slightly paler stripes. *Pleuræ* ochreous on the upper part; a broad chocolate-brown stripe extends from neck to base of abdomen, sharply defined above, but passing beneath into an equally broad greyish stripe; lower part of sternopleura chocolate-brown. Postnotum brownish, rather densely hairy. *Abdomen* mainly light brownish-ochreous, darker apically and at sides of tergites. Ninth segment only slightly developed; anal valves of ovipositor rather short and deep, but longer than the genital valves. *Legs* brownish; tarsi and tips of femora and tibiæ blackened; spurs normal. *Wings* broad, brownish, stigma and a spot over base of *Rs* deeper brown; veins mostly paler brown; sparse yellowish markings arranged somewhat as in *T. thibetana*, de Meij.; a narrow complete yellowish transverse fascia at arculus; *Sc* reaching to within a short distance of the upturned tip of *R*₁; *R*₂ long and complete; *R*₃ somewhat curved; *R*₄₊₅ markedly sinuous, discal cell large. Squama with numerous short black hairs at outer angle. Halteres dark brown.

Length of body 23 mm.; wing 28 × 8 mm.

YUNNAN: Atuntzu, 11,000 ft., 18. vii. 1922, 1 ♀ (*Prof. J. W. Gregory*).

This species belongs to the group of *T. thibetana*, de Meij., *T. tessellatipennis*, Brun., and *T. griseipennis*, Brun.; it is closely related to the first-named, but the thorax is very differently coloured.

Tipula waltoni, sp. n.

♀. Allied to *T. gregoryi*, sp. n., differing as follows:—No black spot above roots of antennæ. Rostrum less dark at sides. Præscutum with four brown stripes, the margins of which are narrowly darkened; middle pair contiguous, but separated from the lateral pair by broadish ochreous lines which reach forwards almost to the front margin, this, however, being narrowly darkened. Sides of scutum paler than centre. Pleural stripes ill-defined, but similarly arranged. Wing-markings slightly different, the narrow transverse fascia at base being incomplete. *R*₄₊₅ less sinuous; *M*₁ with a well-marked vertical section at base. Halteres pale.

Length of body 21 mm.; wing 24 mm.

TIBET: Gyantse, 13,000 ft., vi. 1904, 1 ♀ (*Lt.-Col. H. J. Walton*).

Tipula hobsoni, sp. n.

♀. *Head* chestnut-brown, unmarked, surface dull above, sides of rostrum shining. Front about as broad as one eye, tubercle moderate. Eyes almost touching on under side of head. Rostrum moderately long, nasus scarcely developed. Antennæ with the scape coloured like the head, first segment strongly constricted in middle and with two other minor constrictions; flagellum yellowish

(terminal segments missing), first segment scarcely longer than second, basal enlargements of following segments most distinct on upper side, verticils long. Palpi ochreous. *Thorax* chestnut-brown above, passing to orange-brown on postnotum; no definite markings, but a narrow whitish line on margin of præscutum. Pleuræ with a broad orange stripe from side of pronotum to wing-base, lower part orange-brown. Postnotum with rather dense pale hair. *Abdomen* almost uniformly orange-brown. Ovipositor very short; anal valves not strongly chitinated, hairy on basal half, tip rounded; genital valves pale, shortly conical. *Legs* with coxæ, trochanters, and front femur uniformly orange-brown (rest missing). *Wings* with a strong yellowish-brown tinge, faintly lighter in places, notably at base of discal cell. Stigma not indicated. A faint grey spot in middle of cell *Cu*, and a grey streak along lower edge of discal cell, darker proximally (over basal section of *M*₃), and extending into base of cell *M*₁. A narrow grey seam on outer part of posterior margin, interrupted in middle of cells *R*₁, *M*₁, *M*₂, and *M*₃. Venation: *Sc* reaching nearly to base of upturned tip of *R*₁; *R*₃ long; *R*₂ long and complete; *R*₄ somewhat curved. Discal cell large, very pointed apically owing to the almost horizontal position of *m*. *M*₄ with a rather long vertical section at base. Squama with short hairs at outer angle. Halteres light brownish.

Length of body 25 mm.; wing 29 mm.

TIBET: Yatung, 4500 ft., 1 ♀ (*A. E. Hobson*).

In spite of the very different colouring of body and wings, this evidently belongs to the same group as the last two.

Tipula thibetana, de Meij.

I am indebted to Prof. de Meijere for the loan of the type of this species, on which I have made the following notes:—

Very similar to *T. gregoryi* and *T. waltoni*, but rostrum entirely blackish and first antennal segment dark brown. Between the præscutal stripes is a pair of ochreous lines, which do not nearly reach the front margin; their anterior ends (immediately behind the pseudosuture) are somewhat enlarged, giving the impression of a pair of spots. Pleuræ without definite markings, obscurely darker in middle. Hypopygium: Ninth tergite with a pair of blackened, bare, triangular projections in middle, below each of which a strong tooth projects ventrally. Eighth sternite unmodified. Ninth sternite clothed with dense yellow woolly hair, and with a pair of small pencils of longer orange hair. Outer claspers simple, tapering, broad at base, with tooth-like projection on inner face near tip; inner claspers small, with dense yellow hair at base. Claws toothed. Wings as figured.

Tipula wardi, sp. n.

♂. *Head* rather dark greyish ochreous on vertex, blackish at sides. Front at narrowest point a little over half as broad as an eye, tubercle rather small. Rostrum moderately long, but without

distinct nasus; dorsal surface greyish ochreous, a rather narrow and slightly oblique blackish stripe on each side, below which the colour is dark brown. Antennæ short, dark brown; scape scarcely paler, the first segment with two or three strong constrictions; bases of flagellar segments scarcely enlarged, with moderate verticils. *Thorax*: Pronotum dark brown. Præscutum with three rather broad grey stripes, the middle one darker than the lateral pair, and still darker, almost black, in the middle; all three stripes bordered with dull black, these black borders contiguous between the stripes and also with the broad black margin of the præscutum. Scutum grey, broadly margined with black. Scutellum and postnotum with changeable greyish markings. Pleuræ brownish ochreous above, dark brown below; a broad dull blackish stripe extends from neck to below wing-root. *Abdomen* dark brownish ochreous, darker apically and at sides of tergites; ventral hairs arising from dark dots. Hypopygium small. Ninth tergite broad, gently emarginate, with small median bare projection, the margin of which is split into four points. Eighth and ninth sternites unmodified. Outer claspers ochreous, bilobed, dorsal lobe flattened dorsally and almost bare, ventral lobe thumb-like, pubescent. *Legs* dark brownish, tips of femora still darker; spurs normal, claws simple. *Wings* pale grey, with numerous dark brown spots and clear whitish patches, as shown in figure; veins unusually thin, *Sc* not reaching base of stigma. R_2 long and complete; R_3 curved; R_{4+5} strongly sinuous; discal cell large. Squama with a few minute hairs at outer angle. Halteres with ochreous stem and black knob.

Length of body 21 mm.; wing 26 mm.

S.E. TIBET: Tsangpo Valley, Doshong La; 10,500 ft., 26. vi. 1924 (*F. Kingdon Ward*).

This very handsome *Tipula* is closely related to *T. splendens*, Brun. (E. Himalayas), differing chiefly in the markings of the thorax and wings and in the dark antennal flagellum.

Tipula griseipennis, Brun., var.

TIBET: Tasam, Rongshar Valley, 12,000 ft., 19-28. vi. 1924, 2 ♂. Phusi La, 16,500 ft., 3. vii. 1924, 1 ♀ (*Major R. W. G. Hingston*).

These specimens differ from Brunetti's type (from Badrinath, Garhwal district) in having the first abdominal tergite in both sexes entirely ochreous, without any trace of "two large squarish blackish spots," and the ninth tergite of the ♂ with the median spinulose projection more rounded. Important diagnostic features not mentioned by Brunetti are the following:—Nasus absent. Outer claspers of ♂ deeply divided into two lobes, the dorsal lobe of irregular shape. Pleural suture of hypopygium not indicated. Anal valves of ovipositor rather slender, slightly turned up at tip, of even width throughout (not enlarged at base); genital valves elongate-conical, pointed.

Tipula bodpa, sp. n.

♂. *Head* dark greenish grey without definite markings; rostrum lighter beneath. Front about two-thirds as broad as one eye, tubercle slight; eyes well separated beneath. Rostrum rather short, no trace of nasus. Antennæ with scape ochreous, flagellum black; if bent back would reach about to base of abdomen; verticils moderate, basal enlargements of segments very slight. Palpi black. *Thorax* dark greenish grey; præscutum with three rather broad darker grey stripes, the margins of which are almost black. Scutum unmarked, except for a small blackish spot on each side close to suture. Scutellum, postnotum, and pleuræ without definite markings. *Abdomen* with segments 1 and 6-9 dark, remainder dull ochreous. Hypopygium small. Ninth tergite moderately large, without long hair, equally trilobed at tip, the median lobe simple, rounded, with numerous black spinules. Eighth and ninth tergites unmodified. Outer claspers ochreous, split almost to base into two subequal simple lobes, the ventral lobe rather broader and more pubescent than the dorsal lobe. *Legs* rather short, brownish; tarsi and tips of femora and tibiæ blackened. Spurs normal, claws simple. *Wings* with dark greyish ground-colour, with numerous small yellowish areas as figured. In cell M_1 on vein *Cu* close to its tip is a small grey cloud which is almost surrounded by yellowish. *Sc* ending much before tip of R_1 . *Rs* moderately long, over twice as long as the short R_{2+3} ; R_2 long and complete; R_3 gently curved. M_1 arising near base of discal cell, *m-cu* joining M_1 at its base. Squama with a few short hairs. Halteres ochreous.

♀. Resembles the ♂. Antennæ somewhat shorter. Ovipositor short, orange; anal valves moderately chitinized, of even depth throughout (not enlarged at base) and about half as long again as the conical genital valves.

Length of body 11.5-13.5 mm.; wing 12.5-14 mm.

TIBET: Rongshar Valley, 15,000 ft., 2. vii. 1924, 5 ♂, 1 ♀ (Major R. W. G. Hingston).

Allied to *T. griseipennis*, Brun., but much smaller; wing-markings rather different, flagellum black instead of yellowish, etc. The name "Bodpa" is that of tribes inhabiting southern Tibet.

Tipula trilobata, sp. n.

♂. *Head* dark grey. Front nearly as broad as one eye, frontal tubercle moderate. Rostrum blackish, without definite nasus. Antennæ moderately long and stout, if bent back would reach nearly to middle of second abdominal segment; scape brownish ochreous, flagellum black, segments with slight basal enlargements and very short verticils. Palpi black. *Thorax* dark bluish grey, practically bare. Præscutum with three dull blackish stripes, the middle one very broad. Postnotum when seen from in front appearing to have a broad dull black median stripe. *Abdomen* entirely

dark grey. Hypopygium not very large. Ninth tergite truncate, posterior margin straight and shortly pubescent, with a small, bare, bifid, median projection. Eighth and ninth sternites unmodified. Outer clasper of peculiar shape, enlarged, and trilobed apically, the ventral lobe rather long and pointed, the others rounded. *Legs* brownish; coxæ dark grey; tarsi and tips of femora blackish. Tibial spurs normal; claws simple. *Wings* dark greyish with a conspicuous yellowish pattern, somewhat as in *T. tessellatipennis*, Brun., or *T. griseipennis*, Brun. *Sc* reaching to base of stigma. R_2 long and complete, twice as long as the short R_{1+2} ; R_1 nearly straight; R_s moderately long. Discal cell twice as long as broad; M_1 arising near its base; *m-cu* curved at base. Squama with minute black hairs at outer angle. Halteres brownish.

Length of body about 13 mm.; wing 19 mm.

YUNNAN: Valley west of Tsa-si-lo, over 9000 ft., 5. vii. 1922, 1 ♂ (*Prof. J. W. Gregory*).

Tipula subscripta, sp. n.

Belongs to the *arctica* group of Alexander; closely related to *T. scripta*, Mg. (Europe), and still more to *T. pallidicosta*, Pierre (Central and S. Europe), from which it differs chiefly as follows:—Antennæ longer than in *T. scripta*, but slightly shorter and distinctly more slender than in *T. pallidicosta*; if bent straight back would reach to base of abdomen. Hypopygium: ninth tergite with a reflexible terminal median portion, each corner of this part produced into a small bare black tooth, as in the two species named, this reflexible piece broader than in *T. scripta*, resembling that of *T. pallidicosta*; when reflexed, the ninth tergite appears somewhat saucer-shaped, the lateral portions somewhat projecting, but less so than in the European species. Ventral arm of inner claspers shorter, its tip less blackened; dorsal arm (as seen in end view) with a median external enlargement, its tip slightly bifid, much less so than in *T. pallidicosta*. Wings: venation and markings generally as in the two allied species, but small clear areas present on wing-margin in cells R_5 , M_1 , M_2 , and M_3 ; cell R_5 otherwise dark.

YUNNAN: East of Janula, 11,000 ft., 24. vi. 1922, 1 ♂ (*Prof. J. W. Gregory*).

Tipula avicularia, sp. n.

♂. *Head* greenish grey, more ochreous behind, with indications of a dark median line; front almost as broad as one eye. Rostrum rather short, greyish, nasus rather short. Antennæ with scape yellowish, flagellum dark brown, tips of segments indistinctly paler; if bent back would hardly reach scutellum; verticils rather long. Palpi dark, articulations pale. *Thorax* greenish grey; postnotum and pleuræ behind sternopleura more ochreous. Præscutum with three darker grey stripes, the middle one divided by a pale line (more distinct posteriorly) and with its outer margins somewhat darkened;

lateral stripes with their inner margins distinctly darkened. Scutal lobes mainly dark, a darker brownish line runs from suture and crosses the scutellum and postnotum. *Abdomen* with segments 1-4 and base of 5 rather bright ochreous, with a black mid-dorsal line; remainder black, somewhat shining. Hypopygium rather small. Ninth tergite almost divided by a median membranous area into two lobes; hind border with short dark pubescence and broad V-shaped emargination. Eighth sternite unmodified. Ninth sternite with a pair of pubescent appendages, the tips of which are shaped like a bird's head, the beaks pointing inwards. Pleural suture well marked, the pleurite with rounded margin and a thumb-like ventral process, the tip of which is slightly bifid. Claspers small, the outer finger-like, pubescent, black. *Legs* mainly blackish; coxæ greyish ochreous; femora ochreous at base and with a rather ill-defined ochreous preapical ring. Spurs normal; claws all with small basal tooth. *Wings* brown, with a light pattern arranged almost exactly as in *T. arisanensis*, Edw.; the dark area at the tip almost fills cell R_2 ; pale markings yellowish, except for the spot filling bases of discal cell and cell M_2 , which is whitish. R_s long; R_2 long and complete; R_3 gently curved. Discal cell rather long, M_1 arising near its base; $m-cu$ meeting M_1 exactly at its base. Squama bare. Halteres with ochreous stem, knob blackish except at tip.

Length of body 12-13 mm.; wing 15-16 mm.

TIBET: Yatung, 10,000 ft., 16.iv.1924, type ♂ (*Major R. W. G. Hingston*). Yatung, 4500 ft., 1 ♂ (*A. E. Hobson*).

SIKKIM: Lachen River, 8000 ft., 25.iv.1924, 1 ♂ (*Major R. W. G. Hingston*).

Belongs to the *arctica* group and the subgroup of *T. himalayensis*, Brun., differing from the other members in the structure of the hypopygium and the longer discal cell with more basal origin of M_1 . The resemblance to *T. arisanensis*, Edw. (*Formosa*), is superficial only.

Tipula pleuracantha, sp. n.

♂. Closely allied to *T. avicularia*, sp. n., differing as follows:—Head more extensively ochreous, including rostrum. Antennal flagellum with the first segment yellowish, next few segments yellowish with blackish base, remainder brownish. Middle præscutal stripe without a pale central line, but usually with a dark line instead. Hypopygium similar in structure, but appendages of ninth sternite longer, more slender, and pointed; ventral part of pleurite produced into a long, inwardly directed, sharp, black spine, below the base of which is a broad, finely pubescent lobe. Femora without yellowish preapical ring. Wings broader, the yellow pattern more extensive, but contrasting less with the lighter ground-colour. Discal cell rather shorter; stem of cell M_1 shorter, occasionally absent; M_1 arising rather farther from base of cell and always with a short vertical section at its base.

Length of body 11-14 mm.; wing 14-16.5 mm.

SIKKIM: Tangu, Teesta Valley, 13,000-14,000 ft., 1-15.vii.1903, 18 ♂ (*Lt.-Col. H. J. Walton*).

Tipula scandens, sp. n.

♀. *Head* entirely blackish grey (somewhat discoloured), with very sparse and short black hairs, front bare. Eyes small, very widely separated both above and below. Rostrum of moderate length, without trace of nasus. Antennæ entirely black, first segment unusually short; verticils very short. Palpi black; first segment very short, second also shorter than usual and much enlarged. *Thorax* grey, præscutal stripes not much darker, except for an ill-defined blackish line occupying the middle of the central stripe, and the blackened margins and anterior ends of the lateral stripes. A dark median line on scutellum and postnotum. No pubescence on mesonotum. *Abdomen* dark greyish, with a darker brown mid-dorsal stripe. Ovipositor very stout, of the *arctica* type, outer margins of valves distinctly serrate. *Legs* short and stout; coxæ and tarsi blackish; femora and tibiæ dark brown with tips rather broadly black. Spurs normal; claws simple. *Wings* abbreviated, hardly reaching beyond middle of abdomen. Indications of a marmorate pattern similar to that of the *himalayensis* group; posterior margin of wing whitish, including about the whole of cells M_1 and Cu_1 . R_2 complete. Cell M_1 almost sessile. Discal cell rather long, M_4 arising before one-third of the length of the cell. Squama bare. Halteres blackish, stem lighter.

Length of body 14 mm.; wing 8 mm.

TIBET: Phusi-La, 16,500 ft., 3. vii. 1924, 1 ♀ (Major R. W. G. Hingston).

So far as I am aware, this is the first member of the *arctica* group to be described in which the nasus is lacking; this character should facilitate the recognition of the male, which is doubtless fully winged. In *T. subapterogyne*, Alex. (Formosa), which also belongs to the *arctica* group and has the wings of the female abbreviated, the nasus is long and slender. *T. edentata*, Alex. (Mongolia), has the wings further reduced, nasus present, scape yellow, etc. The reduction of the wings of the present specimen is evidently to be regarded as an adaptation to life at a very high altitude, but there is a reduction rather than an increase of hairiness such as is found in some other high-altitude species.

Tipula tardigrada, sp. n.

♂. *Head* greyish, darker round eyes. Front rather broader than one eye. Antennæ entirely black, rather stout, and moderately long; if bent back would reach almost to middle of second abdominal segment. Flagellar segments with very short verticils and inconspicuous pubescence; base of each segment only very slightly and evenly enlarged. Palpi black. Nasus well developed. *Thorax* practically bare, rather dark greenish grey; four præscutal stripes somewhat darker and rather indefinitely margined with darker grey, the inner dark margins of the median pair of stripes practically contiguous, and thus forming a rather conspicuous blackish central line.

broad and conspicuous black lateral and median stripes. Hypopygium rather small, dark grey. Ninth tergite with a wide V-shaped emargination which almost reaches the base in the middle. Outer clasper small, finger-like, black, blunt-tipped, pubescent; inner clasper large, yellowish. Eighth and ninth sternites unmodified and practically bare. Pleural sutures indistinct. *Legs* rather short, brownish orange; coxæ and trochanters blackish, heavily dusted with grey; tips of femora and tibiæ and almost the whole of the tarsi black. Tibial spurs normal. *Wings* almost unicolorous yellowish brown, only the veins and stigma darker; indications of a clearer area towards end of cell *M* adjoining vein *Cu*, but practically no trace of the obliterative streak. *Sc* ending far before base of upturned tip of *R*. *Rs* rather long; *R*₁ long and complete, twice as long as the short *R*₂₊₃; discal cell rather long; cell *M*₁ about 1.5 times as long as its stem; *m-cu* very oblique, meeting *M*₃₊₄ slightly before the fork. Squama bare, as usual in the *arctica* group. Halteres black.

♀. Resembles the ♂ in colouring. Antennæ short, if bent back would reach to base of wing. Ovipositor with the basal part shining black. Anal valves long, stout, reddish, appearing somewhat as in the *arctica* group, but the ventral edge not turned so much outwards and only very indefinitely toothed; genital valves very short, blackened at base. Legs shorter and stouter than in the ♂. Wings reduced, only about twice as long as the halteres.

Length of body, ♂ 9-10 mm., ♀ 15-17 mm.; wing, ♂ 13.5 mm., ♀ 5-6 mm.

YUNNAN: Valley west of Tsa-si-lo, over 9000 ft., 5. vii. 1922, 1 ♂, 2 ♀ (*Prof. J. W. Gregory*).

Among species of *Tipula* which I have examined, the one which perhaps shows most resemblance to this new form is *T. carinifrons*, Holmgr. (*Novaia Zemlya*), in which the ♀ is likewise subapterous and the ♂ hypopygium is not very dissimilar in structure. *T. carinifrons*, however, is quite distinct in many details, and shows one very peculiar character in the possession of two spurs on the front tibia instead of the usual one.

Tipula nigroapicalis, Brun.

TIBET: Yatung, 10,000 ft., 23. vii. 1924, 1 ♂, Gautsa, 11,500 ft., 21. vii. 1924, 1 ♂ (*Major R. W. G. Hingston*).

In spite of the yellowish, scarcely marmorate wings, this seems to belong to the *scripta* (*arctica*) group. The following diagnostic features may be noted from the series in the British Museum, which includes Brunetti's types:—Nasus rather long and slender. Præscutal stripes with the margins distinctly darkened, the inner margins of the middle pair of stripes nearly or quite contiguous. Hypopygium with the ninth tergite rather weakly chitinised, including a pair of dark plates; hind margin with a small median emargination. Pleurite produced into a rather long, stout process, the tip of which is narrowed and blackened. Outer clasper with

a blunt projection in the middle of the posterior margin. *Ædeagus* complicated, consisting of a black trident with long prongs, below which, in the notch of the ninth sternite, is a fourth black spine, and on each side of the last a shorter brown spine. Ovipositor of the *arctica* type, with sharp teeth. Discal cell short, M_1 arising near its middle.

Tipula tetragramma, sp. n.

♂. *Head* greyish. Front rather more than half as broad as one eye, frontal tubercle very prominent. Rostrum black, without distinct nasus. Antennæ rather short; scape ochreous, flagellum black, segments scarcely enlarged at base and with very short verticils. Palpi black. *Thorax* greyish; præscutum with four distinct blackish stripes, middle pair narrow and well separated, lateral pair broader and extending across scutum. *Abdomen* with the basal segments mainly yellowish, sides darker; last few segments dark. Hypopygium small. Ninth tergite distinctly separated from sternite, divided by a deep V-shaped cleft into two rounded lobes; in the base of the cleft is a small projecting piece which is slightly bifid. Pleural suture distinct. Eighth and ninth sternites unmodified. Outer clasper finger-like, pale, pubescent. *Legs* blackish, bases of femora ochreous. Claws simple. *Wings* with a conspicuous pattern somewhat as in *T. arisanensis*, Edw.; ground-colour dark grey, markings all yellowish; no pale dots along outer half of hind margin. Venation: tip of R_1 obsolete, R_2 very short, its tip pale, hardly distinguishable; R_s long; R_3 straight; stem of cell M_1 rather long; M_1 with a very short vertical section at base. Squama bare. Halteres with yellow stem and black knob.

Length of body about 10 mm.; wing 14 mm.

YUNNAN: valley west of Tsa-sa-lo, 9000 ft., 5. vii. 1922, 1 ♂ (*Prof. J. W. Gregory*).

This species apparently belongs to the *marmorata*-group, and must bear a rather strong resemblance to *T. kiushiuensis*, Alex. (Japan), but differs in many details, such as the form of the ninth tergite and the straight vein R_3 .

Tipula cruciata, sp. n.

♀. *Head* greenish grey, with a narrow dark central line. Front at narrowest point scarcely half as broad as one eye; tubercle moderate, rather distinctly bifid. Eyes well separated beneath. Rostrum rather short, greenish grey above, darker at sides; nasus long, ochreous. Antennæ with scape yellowish, flagellum black; first flagellar segment more or less pale, somewhat swollen, over half as long again as the second; verticils moderate. Palpi black. *Thorax* greenish grey. Pronotum dark brown in middle. Præscutum with five dark brownish stripes arranged as in the European *T. truncorum*, Mg. Scutal lobes dark in middle; scutellum with a dark median line; pleuræ unmarked. *Abdomen* ochreous,

tergites 1-7 with black median and lateral lines, 8 entirely black. Ovipositor ochreous; basal part rather long; anal valves moderately long, slender, straight, and sharply pointed. *Legs* blackish. Coxæ greyish, trochanters ochreous. Femora ochreous at base and each with a rather broad and distinct ochreous ring some distance before the tip. Spurs normal, claws simple. *Wings* rather dark brown; costal cell yellowish; basal half of cell R_2 and outer half of cell of R_3 yellow. Conspicuous whitish markings forming an almost complete band beyond the cord, and a more irregular band in the middle. *Sc* ending far before tip of R_1 ; R_2 complete, but not longer than R_{2+3} ; R_s long; R_{2+3} arched, $r-m$ being placed exactly at its base (a very unusual feature); R_3 nearly straight. Cell M_1 long, with short stem; discal cell pentagonal. Squama bare. Halteres ochreous, base of knob darker.

♂. Resembles the ♀. Antennæ rather short; if bent back would reach about to base of abdomen; first flagellar segment clearer yellow than in ♀. Hypopygium: ninth tergite large, shining dark brown, trilobed apically, the lateral lobes produced, nearly bare with rounded tips. Eighth sternite large, tapering, somewhat boat-shaped, with a small blackened triangle at tip, on the inner surface of which are a number of short reddish setæ. Pleurite small, but suture well defined. Outer clasper short, expanded apically to shape of an axe-head. Inner clasper large, complex, with a large blackened dorsal point and a large ventro-posterior tooth-like projection. Aedeagus with two black hooks.

Length of body, ♂ 12-14 mm., ♀ 15-17 mm.; wing 14-19 mm.

TIBET: Chumbitang, 13,000 ft., 25. vii. 1924, type ♀ (*Major R. W. G. Hingston*).

SIKKIM: Tungu, Teesta Valley, 13,000-14,000 ft., 1-15. vii. 1903, 8 ♂, 2 ♀ (*Lt.-Col. H. J. Walton*).

Readily distinguished from other species with marmorate wings by the position of $r-m$, which is practically constant in all the specimens. The European *T. truncorum*, Mg., has similar thoracic markings and ninth tergite, and would seem to be more nearly allied than any previously described Oriental species.

The wing-markings vary slightly; in some specimens there is no pale area in the outer part of cell R_2 .

Tipula leucosema, sp. n.

♀. *Head* dark greyish, the colour passing to light brownish above base of antennæ. Rostrum with the upper surface brownish yellow, dusted with grey, sides and under surface rather dark brown. Antennæ with the scape yellow, flagellum black. Palpi black. Front rather narrower than one eye. *Thorax* grey, the only distinct markings being four rather narrow and irregular brown stripes on the præscutum; short pubescence present on scutellum and postnotum. *Abdomen* brownish; median area of tergites 2-6 orange, forming a broad, continuous, dorsal stripe; lateral margins

narrowly grey. Anal valves of ovipositor slender, straight, reaching only a little beyond tips of genital valves. *Legs* slender, brownish, tarsi and tips of femora darker. *Wings* variegated with dark brown and milky-white, the dark markings including a large area at the tip (preceded by a continuous white band) and a rather large spot over base of *Rs*. Venation: *Sc* ending well before tip of *R*₁; *R*₁ lacking; *Rs* long; discal cell of moderate size, hardly longer than broad; stem of cell *M*₁ short; *M*₁ with a short vertical section at base. Squama bare. Halteres with blackish knobs.

Length of body (excluding head) 20 mm.; wing 20 mm.

YUNNAN: West of Tseku, Mekong dividing range, 8000 ft., 4. vii. 1922, 1 ♀ (*Prof. J. W. Gregory*).

This fine species appears to be related to *T. futilis*, Alex. (Japan), differing in colouring of antennæ and rostrum and other details. The wing-markings are arranged on precisely the same place as in *T. cruciata*, sp. n.—a fact which certainly indicates a near relationship between the species. No great importance can be attached to the loss of *R*₂ in *T. leucosema*.

Tipula yunnanica, sp. n.

♂. *Head* bluish grey above, with a brown central line anteriorly. Front only half as broad as one eye. Rostrum brownish orange, with an ill-defined brown lateral line; nasus long. Antennæ, if bent back, would reach just beyond base of abdomen; scape orange, flagellum black; basal enlargements of flagellar segments slight, verticils rather long. Palpi black. *Thorax* with grey ground-colour, this including pronotum and pleuræ. Præscutum with four darker grey stripes, the inner pair with both margins darkened, the inner dark margins more conspicuous and almost in contact; outer pair of stripes dark-margined internally but not externally. Scutum with two pairs of confluent dark patches, dark-margined anteriorly. Scutellum with a dark median line. Postnotum with darker grey reflections, variable according to incidence of light, and with rather sparse long pale hairs. *Abdomen* with segments 1–4 mainly orange; tergite 1 with a pair of lateral black patches; a narrow mid-dorsal dark line commences on the outer half of tergite 2 and continues across 3 and 4; segments 5–9 blackish. Hypopygium large. Ninth tergite large, distinctly separated from the sternite, with short dark hair and with a single rather long and narrow median projection, the apical part of which is somewhat compressed and set with minute black spines. Eighth sternite large, without hair-tufts, but with a median projection of similar size and shape to that of the ninth tergite. Outer clasper moderately large, leaf-like, not much longer than broad, white in colour. Inner clasper large, broad, yellow. *Legs* blackish; front coxæ and base of middle coxæ grey; hind coxæ, all trochanters, and bases of femora orange. Tibial spurs normal, claws toothed. *Wings* with a rather strong and almost uniform yellowish-brown tinge, with clear areas as follows:—a broad band before stigma extending from middle of

cell R_1 , across end of cell R and base of discal cell to base of cell M_1 ; a semicircular spot on vein Cu beyond middle of cell M , and two patches in cell Cu , the area between them being darker than the general ground-colour, at least in the ♂. No clear area beyond stigma. Venation: Sc ending far before tip of R_1 ; R_2 complete, about as long as R_{2+3} ; Rs not quite 1.5 times as long; R_3 straight; stem of cell M_1 about as long as m ; $m-cu$ joining discal cell a little before middle at fork of M_{3+4} . Squama with a few minute black hairs on outer angle. Halteres blackish.

♀. Similar in colouring to the ♂. Antennæ shorter than thorax. Ovipositor with the anal valves long, slender except at base, twice as long as the shining black ninth tergite, and in a position of rest projecting well beyond the genital valves, which are also long, but stouter.

Length of body, ♂ 14, ♀ about 17 mm.; wing, ♂ 18, ♀ 19 mm.

YUNNAN: East of Jannula, 11,000 ft., 24. vii. 1922, 1 ♂. S.E. of Atuntzu, 12,000 ft., 20. vii. 1922, 1 ♀ (*Prof. J. W. Gregory*).

This species appears to be referable to the *fulvipennis*-group, but is very distinct from all the Oriental members of the group known to me by the colouring of the thorax and abdomen.

Tipula brunnirostris, sp. n.

♂. Superficially similar to *T. yunnanica*, differing as follows:—Rostrum wholly brownish, not contrasting in colour with the vertex. Tips of flagellar segments yellowish. Præscutum and scutum almost uniformly brownish grey; pronotum and pleuræ yellowish, heavily pruinose. Abdominal tergites 1–4 almost wholly orange. Hypopygium very different. Ninth tergite with the apical half yellowish, median projection rather deeply bifid. Eighth sternite without median projection, but with three prominent ridges on the distal half, the median ridge bare, the lateral ridges with dense golden hair. Outer claspers longer and narrower. All coxæ yellowish. Wings darker towards costa, especially in cells C and Sc ; clear area in cell M much more extensive, but dark spot near middle of cell Cu_2 very indefinite, as is also the outer pale area in this cell. Black hairs on the outer angle of squama more numerous and obvious.

Length of body 15–16 mm.; wing 21 mm.

YUNNAN: Tang-wei-Tang, 9630 ft., 7. vi. 1922, 1 ♂ (*Prof. J. W. Gregory*).

Tipula atuntzuensis, sp. n.

♀. Resembling and evidently allied to *T. yunnanica*, but differing as follows:—Head and thorax more greenish grey above. Pronotum yellowish. Præscutum with four rather narrow dark brown stripes, the two middle ones forked anteriorly, the inner prong of each fork reaching the middle of the front margin, the outer prongs abbreviated. Scutellum without a dark median line. Abdominal tergites 1–4 with a sublateral as well as a median

dark line. Anal valves of ovipositor shorter, about equal to the genital valves. Legs more brownish. Wings similar to those of *T. yunnanica*, but prestigmatic white streak extending into upper corner of cell M_1 and a small white spot present in base of cell M_1 .

Length of body 16 mm.; wing 18 mm.

YUNNAN: S.E. of Atuntzu, 12,000 ft., 20. vii. 1922, 1 ♀ (*Prof. J. W. Gregory*).

Tipula chumbiensis, sp. n.

♂. *Head* rather bright ochreous, with a broad and distinct dark brown central line. Eyes well separated both above and below; front nearly two-thirds as broad as one eye, tubercle only slightly developed. Rostrum short, brownish ochreous, nasus well developed. Antennæ as long as head and thorax together; first three segments ochreous, third a little longer than the first and about twice as long as the fourth, which is brownish with blackened base; remainder black. Verticils confined to upper and outer faces of segments, dorsal hairs of moderate length. Palpi brownish ochreous, last segment black. *Thorax* with the integument wholly dull, but devoid of pruinescence, ground-colour yellowish. Pronotum mainly brownish. Præscutum with three broad but separate brown stripes, the middle one entire, spreading out on front margin, and reaching back to just beyond suture; lateral stripes continued back across scutum, and (more faintly) across sides of scutellum and postnotum, leaving middle of scutellum pale. Postnotum with some black hairs. Pleuræ rather extensively mottled with brown. *Abdomen* with segments 1-3 ochreous, tergites with a black lateral line and slightly darkened in the middle; 4-6 brownish, rest black. Hypopygium moderately large. Ninth tergite rather large and swollen, with a median chitinized projection arising from the base of a deep groove occupying the apical part of the tergite; this projection turned inwards and only visible in end view; in addition, there is a blunt chitinised tooth on the posterior margin of the tergite towards each side. Eighth sternite unmodified. No pleural suture. Outer clasper finger-like, dark brownish. Inner claspers largely blackened. *Legs* dark brown; coxæ, trochanters, and bases of femora ochreous; knees very narrowly whitish. Spurs short, hinder spur of middle tibia absent, or not distinguishable from one of the stiff bristles which form a comb in this position. Claws simple. *Wings* broad, brownish grey, with indistinct clearer areas before and beyond the slightly darker stigma, across base of discal cell, in base of cell M_1 , and (two) in cell M_1 . R_s short, not longer than $m-cu$. R_2 short, but complete. Discal cell rather small. Stem of cell M_1 about as long as m . Cell M_1 more than twice as long as its width on the margin. Alar squama with a small group of black hairs at the angle. Halteres ochreous.

Length of body 11 mm.; wing 13.5 × 4.2 mm.

TIBET: Chumbitang, 13,000 ft., 25. vii. 1924, 1♂ (*Major R. W. G. Hingston*).

This species belongs to a small group of Oriental forms, which includes *T. continuata*, Brun., *T. hampsoni*, Edw., and *T. sessilis*, Edw., from all of which the new species is distinguished by its broader wings and obscurely mottled pleuræ. *T. nipponensis*, Alex. (Japan), probably belongs to the same group, but has a very differently coloured abdomen. All these insects have many features in common with *T. variicornis*, Schum., and related species.

Tipula continuata, Brun.

Examination of several of the specimens which served for Brunetti's description of *T. continuata* shows that he had confused two quite distinct species under this name. Although the description appears to be based in the main on one of these species, the male in the Indian Museum labelled as the type belongs to the other species, some of the characters of which I have briefly noted (Rec. Ind. Mus. xxvi. p. 305, 1924). This species must therefore be treated as the true *continuata* and the description amended accordingly. The following diagnosis has been drawn up from 3♂ in the British Museum from Darjiling, 28. v. 1910, 29. v. 1917, and 2. vi. 1917 (*E. Brunetti*):—

Closely resembles *T. chumbiensis*, sp. n. Eyes rather larger, front hardly more than half as broad as one eye. Dark frontal stripe very indefinite. Middle præscutal stripe tending to be paler in middle and with indications of a dark central line, but not spreading out round front margin. Scutellum pale in middle, as in *T. chumbiensis*. Pleuræ without definite markings, though not conspicuously orange. Hypopygium almost as in *T. chumbiensis*, but sublateral tooth of ninth tergite stronger and outer clasper paler. Legs as in *T. chumbiensis*, with the knees narrowly whitish and middle tibia with only one short spur. Wings narrower, greyer, veins blacker; only one rather distinct clear area in cell *M*.

Tipula xanthopleura, sp. n.

Nearly allied to *T. chumbiensis*, differing as follows:—Rostrum yellow above. Flagellum of ♂ with several segments distinctly yellowish apically, of ♀ nearly all yellow, segments blackened at base. Pronotum yellow at sides. Middle præscutal stripe uniformly chocolate-brown, not spreading out on front margin, sides of præscutum being clear orange-yellow. Anterior ends of lateral scutal stripes in contact with median stripe. Pleuræ uniformly orange. Scutellum with a dark brown median line. Hypopygium much smaller; ninth tergite less swollen, with deep but narrow V-shaped cleft; median projection not visible in the dry specimen. Both pairs of claspers light yellow. Ninth sternite yellow, with a small projecting thumb. Knees not white. Anal valves of ♀ very slender, long, straight, and very slender, but slightly enlarged.

and blunt at tip. Middle tibiae with the hinder spur present but very short; no distinct comb. Wings much narrower; ground-colour more greyish; veins darker; only one clear area in cell *M*. Halteres with stem and base of knob darkened.

Length of body, ♂ 11 mm., ♀ about 15 mm.; wing, ♂ 13×3.5 mm., ♀ 15–16 mm.

TIBET: Yatung, 10,000 ft., 23. vii. 1924, 1 ♀ (*Major R. W. G. Hingston*). KUMAON: Muktesar, ix. 1922, 1 ♂ (type), 1 ♀ (*T. B. Fletcher*). SIKKIM: Darjiling, 7000 ft., 16. x. 1905, 1 ♂ (*E. Brunetti*; paratype of *T. continuata*), and 5. viii. 1909, 1 ♀ (*C. Paiva*).

This is the species confused by Brunetti with *T. continuata* as defined above. The wings of the two species are quite similar, this being probably the cause of Brunetti's mistake.

Tipula subvernalis, Alex. (*fasciculata*, Brun.).

TIBET: Rongshar Valley, 11,000 ft., 23. vi. 1924, 2 ♂ (*Major R. W. G. Hingston*).

Quite similar to specimens from Darjiling.

Tipula hingstoni, sp. n.

♀. *Head* dark fuscous, with variable greyish reflections. Front about as broad as one eye; frontal tubercle practically absent. Rostrum short, hardly longer than diameter of eye, blackish above, dark brown at sides and beneath; nasus moderately long. Antennæ with first segment greyish brown, second more ochreous, remainder black. First flagellar segment slightly longer than first scapal, twice as long as second flagellar. All flagellar segments nearly cylindrical, with rather short, scattered, stiff hairs, chiefly on the upper surface, not forming definite verticils. *Thorax* dark fuscous, slightly shining dorsally, the four præscutal stripes separated by dull lines, the median line practically black, as is the pronotum. *Abdomen* fuscous, slightly shining, with a broad but ill-defined median ochreous stripe. Ninth segment rounded and shining black; valves of ovipositor ochreous, the anal pair moderately long and slender. *Legs* blackish, bases of femora brownish; spurs normal; claws with small basal tooth. *Wings* broad, with a strong smoky tinge, somewhat darker along the veins and on stigma; a broad white band before stigma extending from cell *R*₁ into base of cell *M*₂; no pale area beyond stigma. *R*₂ complete but rather short, shorter than *R*₂₊₃; *Es* about 1.5 times as long as *R*₂₊₃; *R*₃ straight; stem of cell *M*₁ shorter than *m*; *m-cu* just touching base of *M*₁. Squama rather densely hairy at outer angle. Halteres with blackish stem and ochreous knob.

Length of body 23 mm.; wing 28×8.5 mm.

TIBET: Gautsa, 11,500 ft., 21. vii. 1924, 1 ♀ (*Major R. W. G. Hingston*).

The reference of this large and conspicuous insect to *Tipula*

is somewhat provisional; the reduction of the antennal verticils indicates an approach to *Prionocera*, and the rather short rostrum is also found in that genus.

Nephrotoma nigrohalterata, sp. n.

♀. Rather closely resembles *N. flavescens*, L. (*lineata*, Scop.), differing as follows:—Scutellum blackish. Halteres entirely black. Coxæ strongly dusted with grey and rather more hairy. Abdominal tergites with the lateral margins narrowly but almost continuously black. Ovipositor with the anal valves considerably more slender, but less sharply pointed at tip; genital valves much longer, reaching to well beyond middle of anal valves.

Length of body 11.5 mm.; wing 11 mm.

TIBET: Phari, 14,000 ft., 21.vii.1924, type ♀ (*Major R. W. G. Hingston*). Another ♀ from Gyangtse, 13,000 ft., vi. 1904 (*H. J. Walton*), is very similar, but has the scutellum pale and lacks the dull margins to the præscutal stripes; the dull black area below anterior ends of lateral stripes is scarcely indicated.

Nephrotoma distans, sp. n.

♂. Much resembling *N. flavescens*, L., differing as follows:—The black spot at upper edge of each eye larger, triangular. Præscutal stripes almost completely dull; no trace of a deeper black spot on external margin of front end of lateral stripes, but whole margin of præscutum narrowly dark. Scutal stripes almost dull, and practically touching the suture for the whole of their width, leaving only centre and sides of scutum pale. Scutellum darkened. Abdominal tergites with continuous dorsal and lateral black stripes, last two or three segments black. Coxæ more hairy. Hypopygium with median flap of ninth sternite much smaller, only visible in the mounted specimen; a pair of strong, brown, upwardly curved hooks (? parameres) project from the tips of the lobes of the ninth sternite; outer claspers strongly concave outwardly. Wings with a rather strong and uniform brownish tinge, stigma darker brown; *m-cu* joining discal cell a short distance beyond the base; cell M_1 with short stalk.

Length of body 9–10 mm.; wing 10–11 mm.

TIBET: Rongshar Valley, 10,000 ft., 24. vi. 1924, 2 ♂ (*Major R. W. G. Hingston*).

The venational peculiarity of the position of *m-cu* beyond instead of at or just before base of discal cell distinguishes this species from all others of the genus known to me.

Cylindrotoma rufescens, sp. n.

♂. Differs from *C. distinctissima*, Mg., as follows:—Buff colour of whole body replaced by orange. No black marks on sternopleura or on postnotum. Abdomen with a black lateral line commencing near base of segment 2 and running continuously to segment 8, broadening somewhat posteriorly. Hypopygium rather smaller, entirely black in colour, and differing in structure. Ninth tergite with a deeper and narrower median emargination and also

with deeper lateral emargination; seen in side view it appears to have a dorsal conical portion and a ventral thumb-like projection, the latter with longish pale hairs at its tip. *Ædæagus* not formed like a trident; the three openings sessile on a rather stout tube which is slightly expanded at its tip. Femora more broadly black at tips; tibiae and tarsi entirely black; claws smaller. Wings with a rather strong brown tinge, slightly darker at base of *Rs* and along cord; veins appearing relatively less dark and with rather more obvious macrotrichia; *Sc* and *R* yellowish brown; *m-cu* close to base of discal cell; cell M_1 with a rather long stem (this, however, is probably a variable character, as it is in *C. distinctissima*).

Length of body about 10 mm.; wing 9 mm.

TIBET: Chumbi Valley, 10,000 ft., viii. 1927, 1 ♂ (*Lt.-Col. F. M. Bailey*).

Neglecting one species from Japan, this is the first Oriental species of the genus to be discovered.

Limonia yunnanica, sp. n.

Head blackish above, brown beneath, heavily dusted with grey. Front in both sexes almost half as broad as one eye. Rostrum, antennæ, and palpi entirely black; flagellar segments (except first three or four) elongate-oval, with two very long dorsal hairs, 3-4 times as long as the segments. *Thorax* heavily pruinose; dorsum with ground-colour brown. Pronotum dark brown. Præscutum with three blackish stripes, the middle one divided by a brown line on its anterior half. Scutum, scutellum, base of postnotum, and pleuræ mainly blackish, the colour somewhat obscured by greyish dusting. *Abdomen* rather dark brownish ochreous, tergites with blackish median and lateral lines, segments 7-9 in ♂ nearly all black, hypopygium brown. *Legs* with the coxæ brownish ochreous; femora brownish ochreous, tips rather broadly black, preceded by a faintly-indicated yellowish-brown ring; tibiae dark brown, tips blackish; tarsi black. *Wings* with a strong brown tinge, faintly paler in places; darker brown clouds round base and apex of *Rs*; stigma large, rather dark brown, with a yellowish-brown area beyond middle. Venation as figured: *Rs* not spurred at base; tip of R_1 short, at right angles to costa; *m-cu* before base of discal cell; the two veinlets closing discal cell somewhat variable, in the ♂ quite as in typical *Limonia*. Halteres blackish, base of stem brownish ochreous.

Length of body (excluding head) 9-10 mm.; wing 11.5-13 mm.

YUNNAN: S.E. of Atuntzu, 12,000 ft., 20. vii. 1922, 1 ♂ (type), 1 ♀. Kari, 9800 ft., 27. vii. 1922, 1 ♂ (*Prof. J. W. Gregory*).

Belongs to the *bifasciata* group; related to the European *L. quadrinotata*, Mg.

Limonia kashmirica, Edw.

TIBET: Chumbitang, 13,000 ft., 25. vii. 1924, 1 ♂ (*Major R. W. G. Hingston*).

This specimen is considerably darker than the type (a ♀ from

Kashmir, 11,000–13,000 ft.). Front narrower, only half as broad as one eye. Præscutal stripe darker; scutum mainly shining blackish. Legs darker, the preapical yellowish ring on the femora much more distinct. Wings with the dark markings rather more extensive, but the arrangement quite the same; *m-cu* before middle of discal cell. Halteres blackish, except for base of stem and tip of knob.

Dicranomyia baileyi, sp. n.

♀. *Head* greyish brown, dusted with light grey, especially on the narrow front. Rostrum, palpi, and antennæ blackish; flagellar segments oval, short-haired (last few missing). *Thorax* brownish, pruinose; a darker brown stripe on middle of pronotum and præscutum; scutum largely dark brown. Scutellum, sides of pronotum, and most of pleuræ greenish. *Abdomen* greenish. Anal valves of ovipositor moderately long, slender, and nearly straight. *Legs* with coxæ and trochanters greenish. Femora blackish on about the basal half, becoming gradually lighter on the apical half, but with an indistinct darker ring before the tip. Tibiæ and tarsi dark brownish. *Wings* somewhat iridescent, but slightly milky when viewed obliquely against a dark background; base yellowish; a conspicuous dark brown pattern as shown in figure; on front margin of wing towards tip a yellowish-brown shade. *Sc.* apparently absent. Halteres rather short, pale.

Length of body 7 mm.; wing 10 mm.

TIBET: Chumbi Valley, 10,000 ft., 27. ix. 1927, 1 ♀ (*Lt.-Col. F. M. Bailey*).

Dicranomyia innocens, Brun.

TIBET: Yatung, 10,000 ft., 23. vii. 1924, 1 ♂, 1 ♀. Rongshar Valley, 15,000 ft., 2. vii. 1924, 1 ♀ (*Major R. W. G. Hingston*).

This is perhaps a variety of the widely-distributed *D. sordida*, Brun., lacking the small dark clouds at arculus, base of *Rs*, and stigma, and with rather longer spines on rostrum of hypopygium. The Tibetan specimens are larger than a paratype in the British Museum from Kumaon (wing-length 8–9, instead of 6 mm.); *Rs* and apical cells of wing relatively longer.

Neolimnophila fuscineris, sp. n.

♀. *Head* dark greyish brown, mouth-parts and antennæ black. Four basal segments of flagellum fused, the ten beyond slender but distinctly separated. *Thorax* with blackish integument, heavily pruinose with grey except on the præscutum, where the pruinosity is brown, with a broad darker brown median stripe. *Abdomen* blackish. *Legs* blackish. Front tibia without spur; mid and hind tibiæ each with a single short spur. *Wings* greyish, with the base yellow; all veins except *M* and *An* seamed with fuscous, most broadly so on *Cu* and along the cord; costal cell

entirely fuscous; r at base of R_2 ; $m-cu$ near base of discal cell. Halteres yellowish.

Length of body 8 mm.; wing 10 mm.

YUNNAN: S.E. of Atuntzu, 12,000 ft., 20.vii.1922, 1 ♀ (Prof. J. W. Gregory).

Very distinct from the other species by the striate wings.

Rhaphidolabis punctipennis, sp. n.

♂. *Head* dark greyish brown, front wide. Antennæ and mouth-parts black. Antennæ 15-segmented, flagellar segments small, rounded, almost bare. *Thorax* dark greyish brown, pruinose; præscutum with three dark brown stripes, the middle one broad and entire; scutum unmarked. *Abdomen* blackish, including hypopygium. Ninth tergite large, with a deep V-shaped emargination, the lobes reaching beyond the claspers. *Legs* dark brown. *Wings* with clear ground-colour, base yellowish; a conspicuous dark brown pattern as figured. Veins Sc , R , M , and An very pale. Halteres pale.

Length of body 4.5 mm.; wing 8.5 mm.

TIBET: Yatung, 10,000 ft., 17.iv.1924, 1 ♂ (Major R. W. G. Hingston).

Allied to *R. fascipennis*, Brun., but the dark wing-markings much stronger and the spots more numerous. There is a slight superficial resemblance between this species and *Dicranomyia baileyi*, sp. n., which is found in the same locality.

Rhaphidolabis sordida (Brun.)?

TIBET: Gautsa, 11,500 ft., 21.vii.1924, 1 ♀ (Major R. W. G. Hingston).

EXPLANATION OF PLATE XIX.

Wings of Tipulidæ from Yunnan and Tibet; various magnifications, from 2 to 7 diameters. Photographed from wings pasted on white card. ☐

- Fig. 1. *Tipula gregoryi*, sp. n.
- Fig. 2. — *waltoni*, sp. n.
- Fig. 3. — *thibetana*, de Meij.
- Fig. 4. — *wardi*, sp. n.
- Fig. 5. — *bodpa*, sp. n.
- Fig. 6. — *trilobata*, sp. n.
- Fig. 7. — *avicularia*, sp. n.
- Fig. 8. — *pleuracantha*, sp. n.
- Fig. 9. — *yunnanica*, sp. n.
- Fig. 10. — *brunnirostris*, sp. n.
- Fig. 11. — *tetragramma*, sp. n.
- Fig. 12. — *xanthopleura*, sp. n.
- Fig. 13. — *chumbiensis*, sp. n.
- Fig. 14. — *leucosema*, sp. n.
- Fig. 15. — *cruciata*, sp. n.
- Fig. 16. *Limonia kashmirica*, Edw.
- Fig. 17. — *yunnanica*, sp. n.
- Fig. 18. *Dicranomyia baileyi*, sp. n.
- Fig. 19. *Neolimnophila fuscinervis*, sp. n.
- Fig. 20. *Rhaphidolabis punctipennis*, sp. n.

LXXXV.—*Freshwater Copepoda from the New Hebrides.*
By A. G. LOWNDES, M.A., F.L.S.

[Plates XX. & XXI.]

IN 1927 Dr. J. R. Baker and his party visited the New Hebrides under the Percy Sladen Trust, and they took considerable care over the making of a collection of freshwater Copepoda, which they were good enough to send along in due course for identification.

I had previously asked Dr. Baker to collect freshwater Copepoda for me, and I wish to express my thanks both to him and his party, and also the Percy Sladen Trust.

The collection consisted of eleven samples all taken from a large lake on the Island of Gaua. Observations were also made on the pH and temperature of the water which made the collections even more valuable.

The lake is apparently a large one and is over 300 feet deep. The pH at the surface of the middle of the lake was found to be 8.5 and the temperature 25° C. A fuller description of the lake and various observations made will, I understand, appear in due course and be written by Dr. Baker himself, so no further description is here necessary.

In addition, I received two samples which were collected from Hog Harbour, Santo. These only contained one species of Copepoda, namely, *Cryptocyclops anninae*, Menzel.

The following is a list of the species of Copepoda obtained :—

From Lake on Gaua.

Nitocra lacustris, Schmankevitch.

Mesocyclops crassus, Fischer.

— *obsoletus*, Koch.

Leptocyclops prasinus, Fischer.

Cryptocyclops bicolor, Sars.

From Hog Harbour, Santo.

Cryptocyclops anninae, Menzel.

The nomenclature and classification used is that of the late Prof. G. O. Sars in 'Crustacea of Norway' and his latest paper, "The Freshwater Entomostraca of the Cape Province."

A brief description of each of the samples is given below.

The numbers simply represent the order in which the samples were examined:—

- No. 11. June 1st.—Plankton taken with small tow-net, 30 minutes' surface-haul from camp towards Garat and back, 3.15 p.m. Overcast.

The sample consisted almost entirely of *Mesocyclops crassus*. There were also a few Cladocera.

- No. 7. June 2nd.—Tow-netting, taken with large net near Cape Forgetfulness. 20 minutes' haul. Surface.

There was very little in this tube. A few immature *Mesocyclops obsoletus* and also *Mesocyclops crassus*.

- No. 8. June 2nd.—Tow-netting, taken with small net near camp. Overcast, 3.30 p.m. Surface-haul, 15 minutes.

The sample consisted of great quantities of *Mesocyclops crassus* and Cladocera.

- No. 4. June 2nd.—Taken with bolting-silk hand-net. Close to shore.

The sample contained *Nitocra lacustris*, *Mesocyclops crassus*, *Mesocyclops obsoletus*, *Cryptocyclops bicolor*. Copepoda were rather scarce.

- No. 5. June 3rd.—Plankton taken with small tow-net. Surface-haul started deep. Untimed. Between camp and Garat. Sunny, rough.

The sample consisted of great quantities of *Mesocyclops crassus*, and all stages were represented.

- No. 10. June 3rd.—Plankton between Cape Forgetfulness and camp, with small tow-net weighted. 15 minutes' haul, 5 p.m.

The sample consisted of *Mesocyclops crassus*, with very few *Mesocyclops obsoletus*. Considerable quantities of Cladocera were present.

- No. 3. June 4th.—Middle of Southern Basin, 4 p.m. Small tow-net, 15 minutes' haul. Surface, starting deep.

The sample consisted of great quantities of *Mesocyclops crassus*. Adult males and females, young and nauplii.

- No. 1. June 5th.—Near Garat. Surface-haul with small tow-net, about 11 a.m. Overcast.

The sample consisted almost entirely of

Mesocyclops crassus. Adult males and females, young and nauplii. No other Copepoda present.

- No. 9. June 5th.—Night haul, about 9.30 p.m., with tow-net, 15 minutes' haul. No moon, overcast, but not quite dark.

Mesocyclops crassus abundant and many Cladocera.

- No. 2. June 5th.—Taken near the shore with bolting-silk hand-net.

The sample contained *Nitocra lacustris*, *Leptocyclops prasinus*, *Cryptocyclops bicolor*.

- No. 6. June 6th.—Plankton taken with small tow-net from S.W. basin of lake, 15 minutes' haul. Overcast, calm, 2.30 p.m. (Part of haul lost.)

The sample consisted entirely of *Mesocyclops crassus*.

Copepods from water from empty coconut-shells, Hog Harbour, Santo, 21st February.

Two samples sent, both contained several specimens of *Cryptocyclops anninae*, Menzel.

DESCRIPTION OF SPECIES.

Nitocra lacustris, Schmankevitch. (Pl. XX.)

Syn., according to Robert Gurney, Trans. Zool. Soc. part 4, 1927, Cambridge Expedition to the Suez Canal, p. 549:—

Transfuga lacustris, Schmankevitch (1875).

Canthocamptus treforti, Daday (1884).

Canthocamptus yahiai, Blanch. & Rich. (1891).

Nitocra simplex, Schmeil (1894).

Nitocra muelleri, Van Douwe (1905).

Nitocra yahiai, Sewell (1924).

Nitocra treforti, Chappuis (1923).

Nitocra lacustris, Borutzky (1927).

Female.—Length without setæ, .48 mm. The greatest width of the cephalic segment is .14 mm., while the least width across the tail at the base of the caudal rami is .064. The animal is, therefore, of a somewhat shortened or stumpy appearance.

The *ovisac* is broad and flat, nearly twice the width of the anal segment and extends well beyond the caudal rami.

The posterior margins of the abdominal segments are smooth dorsally in the middle line but with a lateral ring of spinules. On the ventral side these spinules form a continuous ring in segments 2 and 3, while in segment 4 there is a short smooth space left at either side.

The posterior edge of segment 5 (anal segment) bears

dorsally a ring of stout spines. Ventrally these spines are replaced by much finer spinules.

The operculum bears about eight spines. These spines are not quite as coarse as those surrounding the caudal rami.

Caudal rami seen dorsally are rather broader than long. Of the two apical setæ the inner is just over twice the length of the outer. There are two inner setæ, one of which is dorsal.

First antenna is relatively short, being nothing like as long as the cephalic segment.

The second antenna bears a single-jointed R.E. with three setæ.

Leg 1. R.I. very slightly longer than R.E., first joint equal to the other two combined. The last two joints are somewhat tapering. The last joint of R.E. is decidedly broad.

Leg 2. R.I. has a seta-formula 0.1.3.

Legs 3 & 4. Setæ for R.I. 0.1.5 in both cases. R.I. of the fourth leg is rather shorter relatively than the R.I. of the third leg.

Fifth leg. Distal joint rather broad and extending well beyond the inner expansion of the proximal joint. It bears six setæ, of which the two inner and terminal ones are long.

The inner expansion is broad and bears five setæ, of which the fourth is twice as long as the others.

Male.—Length .38 mm. Differing but little from the female. The spines and spinules on the abdominal segments are identical, except those on the ventral side of the anal segment. These are distinctly coarser than the corresponding spinules in the female.

The first leg is identical, except that it has the characteristic modified spine.

Penultimate joint of the prehensile antennæ is decidedly toothed.

The fifth foot has its distal joint rather oval in outline and bears six setæ. The inner expansion of the proximal joint is much reduced, and bears an inner spine and an outer seta.

Occurrence. This now a well-known species, though it has been recorded under several names, as shown above. It is recorded from the British Isles (Gurney), Germany (Schmeil), Hungary (Daday), Algeria (Blanchard and Richard); India, Chilka Lake (Sewell).

Mesocyclops crassus (Fischer).

Syn.: *Cyclops oithonoides*, var. *hyalina*, Schmeil.

Cyclops hyalinus, Linde, Richard, Lilljeborg.

This is a well-known species and, since it is fully described

and figured by Sars in 'Crustacea of Norway,' there is no necessity to describe it here.

The species occurs fairly frequently in the British Isles, but it cannot be called common. I have taken many specimens from Cambridge and compared them closely with those from the present station and failed to find any difference whatever. This is of interest, since it is by far the most abundant species in the collection, and the conditions under which it exists at Gaua are very different from those of Cambridge. At Gaua it is found as a true limnetic species in a large and deep lake with the temperature of 25° C. At Cambridge it occurs in quite small ditches and ponds, and the temperature cannot be anything like so constant, nor is it likely to be so high. In addition, at Gaua the species seems to occur in association with no other species and only occasionally with a few Cladocera, while at Cambridge it occurred in association with many other *Cyclops* as well as Cladocera.

It is interesting to be able to record another example in which a well-known European species occurs in a widely-separated district and under very dissimilar conditions, and yet the most careful examination fails to reveal any outstanding differences in structure etc.

Occurrence. In addition to Europe the species is recorded from India, Central Africa, South Africa.

Mesocyclops obsoletus (Koch).

Syn.: *Cyclops leuckarti*, Claus.

Cyclops simplex, Poggenpol.

Cyclops scourfieldi, Brady.

This is probably the best known of all species of *Cyclops*. It is fully described and figured by Sars. The species has so many rather outstanding characteristics that it is of the greatest use for critical examination for the influence of environment.

The species is not particularly well represented at Gaua and nothing like so abundant as *Mesocyclops crassus*.

The most careful examination fails to reveal any outstanding differences between specimens taken from Gaua and the British Isles. The species is rather variable in size and also in the nature of the hyaline plate on the end joint of the anterior antenna, but there is no greater variation to be found by comparing specimens from districts widely separated, such as Marlborough and the New Hebrides,

than in those found in a single pond or area of uniform conditions.

Occurrence. The occurrence and distribution of this species are truly remarkable. It is recorded from the Equator to well within the Arctic Circle. It is also recorded from Patagonia.

Leptocyclops prasinus (Fischer).

Only two specimens occurred of this species, and they were found near the shore. The European descriptions of this species are not satisfactory and it is not described or figured in 'Crustacea of Norway.' Sars has recently described and figured this species from South Africa and the Gaua specimens exactly agree with his description. They show considerable difference from the usual form recorded in the British Isles.

The specimens obtained were not sufficiently good to supply material for a full description of this species, which is badly needed.

Cryptocyclops bicolor, G. O. Sars.

This is a well-known species. It is quite small, the average length of the European specimens according to Sars being .6 mm. Specimens from Gaua hardly attained the length of .5 mm. In spite of this being such a small species, it yet lends itself to a very critical examination, since it possesses several characteristics that put its correct identification beyond doubt.

In the first case it is a *Cryptocyclops* with an eleven-jointed anterior antenna.

The apical setæ are very characteristic, the inner corner seta being shorter than the caudal rami, while the two median setæ are stout and somewhat subequal. Finally, there is the fourth pair of swimming-feet. The outer ramus bears on its terminal joint two very much reduced spines and one normal one, while the proximal joint bears one reduced spine. The inner ramus bears on its terminal joint two spines at the tip, the outer one of which is a mere vestige.

The second basal joint is fringed along its inner edge with spinules which are again very characteristic.

Careful measurement shows that the Gaua specimens are certainly smaller, and there is a slight elongation of the apical setæ compared with the British specimens.

Occurrence. This species has a wide distribution. In addition to Europe, it is recorded from Persia, India, Central Africa, Sumatra, Siam, North America.

Cryptocyclops anninæ, R. Menzel. (Pl. XXI.)

Syn.: *Cyclops anninæ*, R. Menzel, Ann. Biol. Lacustre, t. xiv. (1926).

The following measurements and observations were made from a number of dead specimens which appeared to be normal and show no apparent distortion:—

Adult female bearing egg-sacs:—	mm.
Length exclusive of setæ	·4
Length of trunk	·26
" tail	·15
" cephalic segment	·19
" caudal rami (outside edge)	·03
" inner apical seta	·23
" outer apical seta	·12
" inner corner seta	·008
" outer corner seta	·052
Width of cephalic segment (greatest)	·19
" fourth trunk-segment	·13
Greatest width of genital segment	·10
Least width of caudal rami	·016
Length of anal segment	·02

Ratios:

Length of trunk : tail	1·74 : 1
" ceph. seg. : next four segments	2·7 : 1
Ceph. seg. length : width	1 : 1
Trunk, length : width	1·37 : 1
Caudal rami, length : least width	1·87 : 1
" length : inner corner seta	3·75 : 1
" length : outer corner seta	·58 : 1
Length of I.C.S. : O.C.S.	·15 : 1
Longer apical seta : tail	1·53 : 1
Longer apical seta : shorter	1·9 : 1

Description.—As the above figures show, the cephalic segment is large and more than twice the length of the next four segments.

The whole of the dorsal surface is covered with minute denticles. In the preserved specimens I am unable to see any vestige of an eye.

The trunk-segments are extended laterally.

The fifth segment is quite short and not very broad.

The *genital segment* is remarkably expanded on either side. It is almost as broad as the fifth trunk-segment and overlaps the next segment on either side.

The last three abdominal segments are quite normal in appearance, though broad in comparison with the length of the animal.

The anal segment bears on its posterior edge a ring of spinules which are conspicuous on the ventral surface, where they surround the caudal rami. Dorsally they are much less pronounced.

The segment is extended dorsally to form a conspicuous *anal operculum*, which is triangular in shape, quite smooth, and extends to a distance of well beyond the middle point of the caudal rami.

The *anterior antennæ* are eleven-jointed and reach back rather beyond the middle point of the cephalic segment.

The *posterior antennæ* consist of four well-defined joints.

Swimming-feet. Both rami of all four pairs are two-jointed and the joints are well defined. In all cases the outer ramus is much larger than the inner.

The outer basal joint of P.1 bears at its inner corner a conspicuous spine surrounded at its base by fine spinules. The second joint of the inner ramus bears terminally a strong spine, but no other armature except spinules.

The inner ramus of P.4 is much reduced. It bears terminally four spines.

The *fifth foot* is very rudimentary, being almost completely confluent with the corresponding segment. Its joints are apparently represented by two small protuberances. The one is dorsal and bears a short seta, the other is ventral and bears two setæ, of which the inner is quite twice the length of the outer.

The *caudal rami* are short and rather tapering. They are longer than the anal segment. Dorsally they have a well-marked ridge which ends in the dorsal seta. The inner edge is smooth, while the outer edge bears the lateral seta at about its middle point. Of the apical setæ the inner is much the longer, while the inner corner seta is minute.

The *ovisacs* contain a few large eggs, .08 mm. in diameter.

It was not possible to make out the seminal receptacle, but the spermatophores are exceptionally thick and resistant. They are not usually removed by boiling for one minute in potash.

I think there can be no doubt that this is the species recorded and described by Menzel from Java, though it appears to differ in one or two points.

Occurrence. The specimens were taken from the water in empty coconut-shells, Hog Harbour, Santo, New Hebrides.

GENERAL REMARKS.

The number of species is small, and in this respect it is rather disappointing. At the same time it has given one the

opportunity of revising the records of at least five well-known European species, and some of the older records of European species in distant lands require confirmation badly. It is rather surprising that no Calanoids are represented.

EXPLANATION OF THE PLATES.

PLATE XX.

Nitocra lacustris.

- Fig. 1. Female, last two segments, ventral.
- Fig. 2. Female, last four segments, dorsal.
- Fig. 3. Male, posterior edge of last segment, ventral
- Fig. 4. Female, first antenna.
- Fig. 5. Male, last two joints of first antenna.
- Fig. 6. Female, second antenna.
- Fig. 7. " first swimming-foot.
- Fig. 8. " second swimming-foot.
- Fig. 9. " third swimming-foot.
- Fig. 10. " fourth swimming-foot.
- Fig. 11. " fifth swimming-foot.
- Fig. 12. Male, fifth swimming-foot.

PLATE XXI.

Cryptocyclops anninæ.

- Fig. 13. Female, first antenna.
- Fig. 14. " second antenna.
- Fig. 15. " first swimming-foot.
- Fig. 16. " fourth swimming-foot.
- Fig. 17. " fifth swimming-foot.
- Fig. 18. " connecting lamella of fourth swimming-foot.
- Fig. 19. " last segment with anal operculum and caudal rami, dorsal.
- Fig. 20. " genital segment, with spermatophores attached.
- Fig. 21. " adult animal, with ovisacs.

LXXXVI.—*On the Life-history of the Common Nematode of the Dogfish (Scyllium canicula).* By J. H. LLOYD, M.Sc., F.Z.S., Department of Zoology and Comparative Anatomy, University College, Cardiff.

In a previous communication (3), dealing chiefly with the anatomy of the worm, I stated that, following up the suggestion of Van Beneden (1), I had attempted the experimental infection of the common shore-crab, *Carcinus mænas*, with the larvæ of *Proleptus scillicola*, the common nematode of

the dogfish, *Scyllium canicula*. Altogether a hundred crabs were used in the experiments, fifty-nine for artificial feeding and forty-one as controls. Eight of the experimental crabs were found to be infected with *Proleptus* larvæ, forty-three larvæ being found, but of these only one was of such a size as to justify the conclusion that it had occurred as the result of artificial infection. On the other hand, two of the controls were found to be infected, six larvæ being discovered. It was therefore obvious that, except for the one larva, the infection had occurred in Nature.

There is, however, a distribution difficulty in accepting *Carcinus mænas* as the normal intermediate host of *Proleptus scillicola* in that it rarely occurs at a greater depth than 3 to 4 fathoms. *Scyllium canicula* does not occur normally at a less depth than 13 fathoms, but at the breeding-season comes closer inshore, and it was suggested that in this way it might be at least partially infected. The shore-crab can therefore be regarded as an intermediate host, but probably not the normal one.

Vaullegeard (5) in 1896 reported the larva of *Coronilla robusta* (syn. *Proleptus scillicola*) from a number of crustaceans, but stated that it was rare. In addition to *Carcinus mænas* he found it in *Portunus marmoratus*, Leach, *Hyas araneus*, Linnæus, and *Eupagurus bernhardus*, Linnæus, but found only a single example in each of the last three hosts. He also discovered later a dozen nematode larvæ, which apparently he did not identify, in *Portunus depurator*, Pennant (= *P. marmoratus*, Leach).

During the course of the experimental work on the life-history of *Proleptus* I dissected a number of specimens of *Eupagurus bernhardus*, but failed to find any larvæ. As far as I can recollect, as the original work was carried out several years ago, my examination was more or less restricted to the "liver" on the assumption that the larvæ would occur in the same location as in the shore-crab.

Recently during class-work at Cardiff seventeen specimens of *Eupagurus* were dissected. Of these six were found to contain *Proleptus* larvæ, forty specimens being found. All the specimens occurred in the anterior portion of the body-cavity (cephalothorax) and not in the "liver."

I have since examined twelve further specimens of *Eupagurus*, but did not succeed in finding any nematode larvæ.

Summarising the results of my observations, it is seen that out of a hundred *Carcinus mænas* 10 per cent. were infected, forty-nine larvæ being found. Out of thirty specimens of

Eupagurus bernhardus 20 per cent. were infected, forty larvæ being found.

These results clearly show that the hermit-crab is a definite intermediate host of *Proleptus scillicola* and, both because its distribution agrees more closely with that of the dogfish and because remains of hermit-crabs are frequently found in the stomach of the dogfish, it is highly probable that it is a normal host.

It is interesting to note that Jackson (2), in 1913, stated "I have found no internal parasites in the species under consideration (*Eupagurus bernhardus*), and I do not believe any have been recorded." This statement is not quite correct, as Vaullegeard observed his solitary specimen of *Proleptus* in 1896. The present record confirms his observation.

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- (4) M'INTOSH, W. C. Q. J. M. S. vol. vi. (new series), 1865, pp. 201-204.
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BIBLIOGRAPHICAL NOTICE.

Popular Handbook of Indian Birds. By HUGH WHISTLER, F.L.S., F.Z.S. Pp. 438, 4 coloured plates, and 11 full-page black-and-white plates containing 81 figures by H. Gronvold. London: Gurney & Jackson. Price 15s.

MANY attempts have been made by various authors to write a book on the Common Birds of India—a work of no little difficulty when one considers the immense size of the country and the extraordinary variations in its climatic conditions. Our present author, Mr. Hugh Whistler, is a young ornithologist whose carefully written articles on local birds which have appeared from time to time in the 'Journal of the Bombay Natural History Society' have already earned him the reputation of a keen observer and a painstaking writer. The present work will confirm this reputation.

Naturally when an author, whose experience of Indian birds has been confined to one small portion of that vast empire, writes on the "Common Birds of India," he is very apt to become a writer on the Common Birds of the particular locality with which he is best

acquainted. Hence the present author is dominated by his knowledge of the birds of the Punjab and North-west India. For instance, when he deals with the laughing thrushes, he gives us as his type *Garrulax albogularis*, a common bird of the West, but leaves out such birds as *G. moniliger* and *G. leucolophus*, still more common in the East. Again, in the genus *Trochalopteron* he deals only with the North-west forms with the one exception of *cachinans* from the South, ignoring altogether the most common Eastern species. Similar instances are the acceptance of *Sypheotides indica* and *Turnix dussumieri* as common birds, whilst he omits *Sypheotis bengalensis* and *T. javanica*. Then, when he comes to the family of storks, our author only mentions the white-necked stork and, curiously enough, never even refers to the adjutant. Of the herons also he selects the grey heron as a common bird and ignores the purple heron.

Still, on the whole, Mr. Whistler has given us a book that will give an immense amount of information to visitors in India. His descriptions are simple and fairly well to the point, while his notes on field-identification will further assist observers to identify the birds they see. The field-notes, as well as those on nidification, are on the whole excellent, though in some cases, as, for instance, in regard to the breeding-ranges of the various forms of the common cuckoo, our author goes rather widely astray, whilst naturalists who are well acquainted with the Himalayan cuckoo will probably be amused by his terming the call of that bird "a dull booming note." We note that our author asserts that the hill-men are quite unaware of the parasitic habits of cuckoos; this is correct only in regard to the hill-men of the north-west, for all those of the east and most of those of the south are well acquainted with the habits of the various cuckoos.

In his preface the author gives us at some length his ideas on classification, and tells us what genera, species, and subspecies are. These definitions, although, perhaps, not very scientific, will be sufficient to assist the beginner to understand what is meant by them, and we commend also Mr. Whistler's remarks on certain points on which further information is desirable. Here and there, as is, perhaps, only natural in a book of this character, there are mistakes in nomenclature, as, for instance, in the name of the little warbler—*Phylloscopus humei premium*,—although Blyth himself said that his name *inornatus*, used by Mr. Whistler, had been wrongly given, and could not be maintained. The get-up of the book is extremely good, whilst the plates by H. Gronvold are excellent and fully worthy of the great reputation of that artist; on the other hand, the great weight of the paper used is undoubtedly a drawback. We can confidently recommend this book to anybody intending to visit India, and are sure that it will greatly assist those who love birds to find out the names of many of those they may happen to see.

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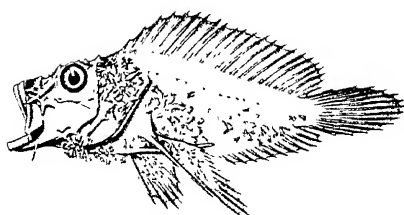
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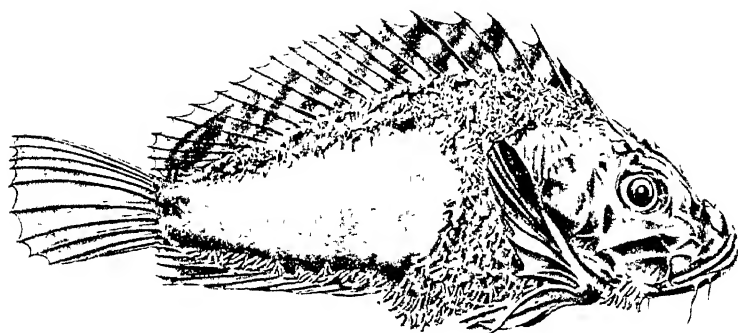
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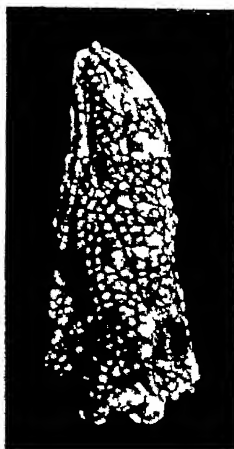


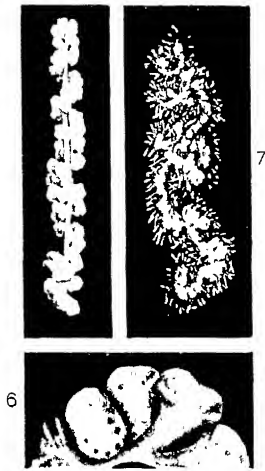
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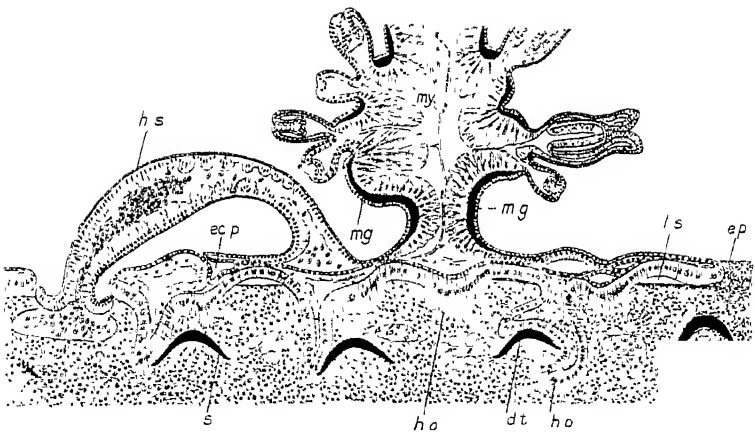
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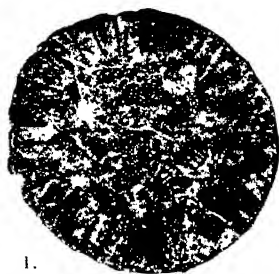




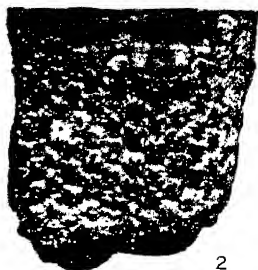
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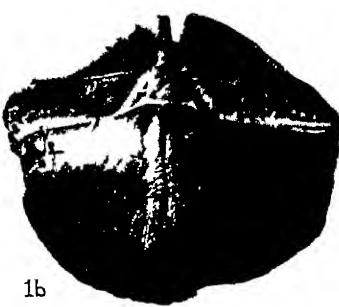
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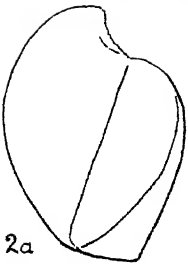
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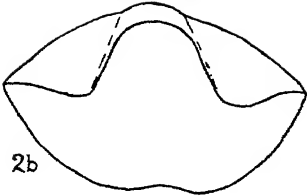
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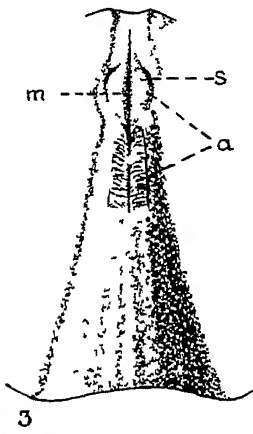
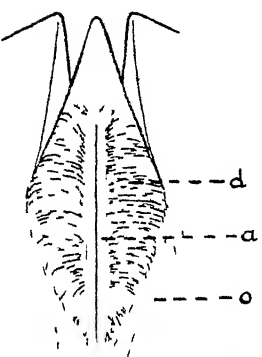
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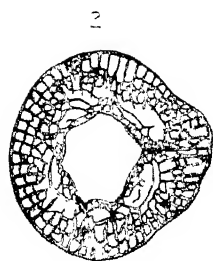
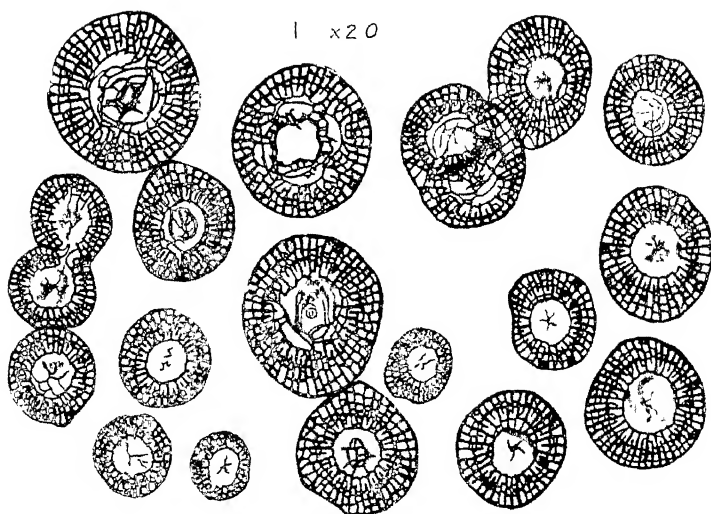


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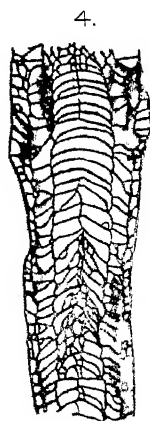


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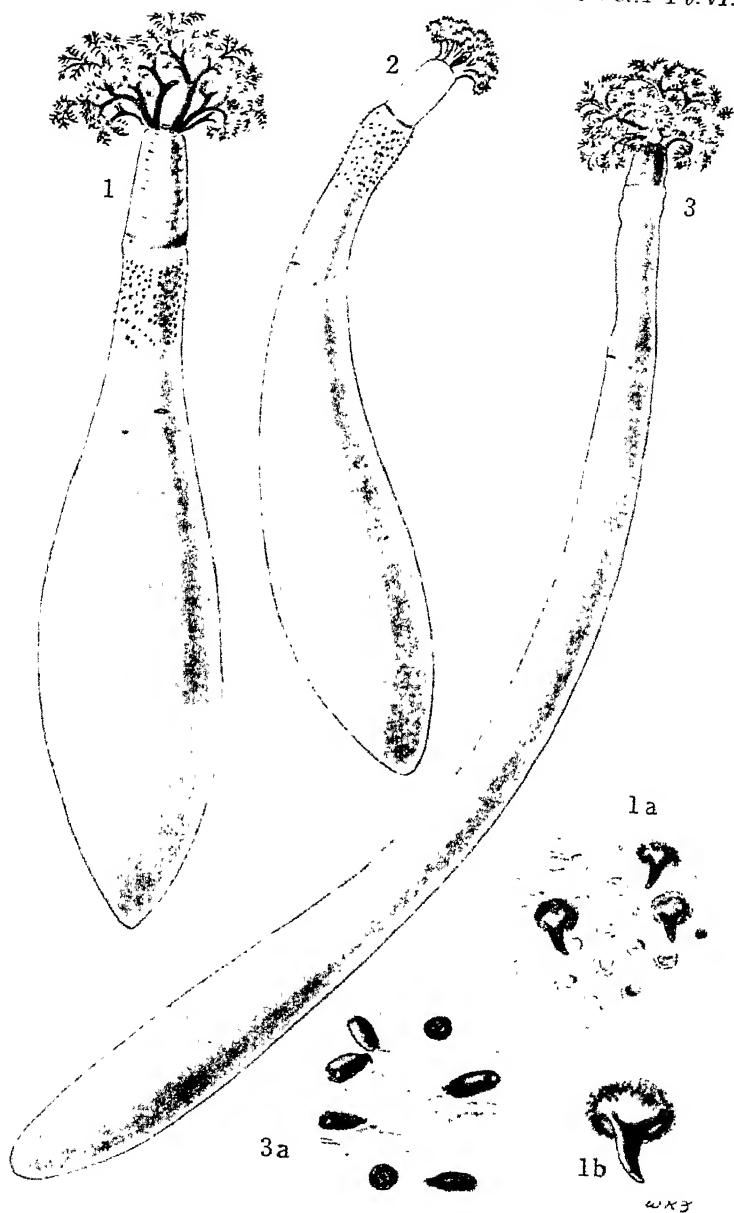
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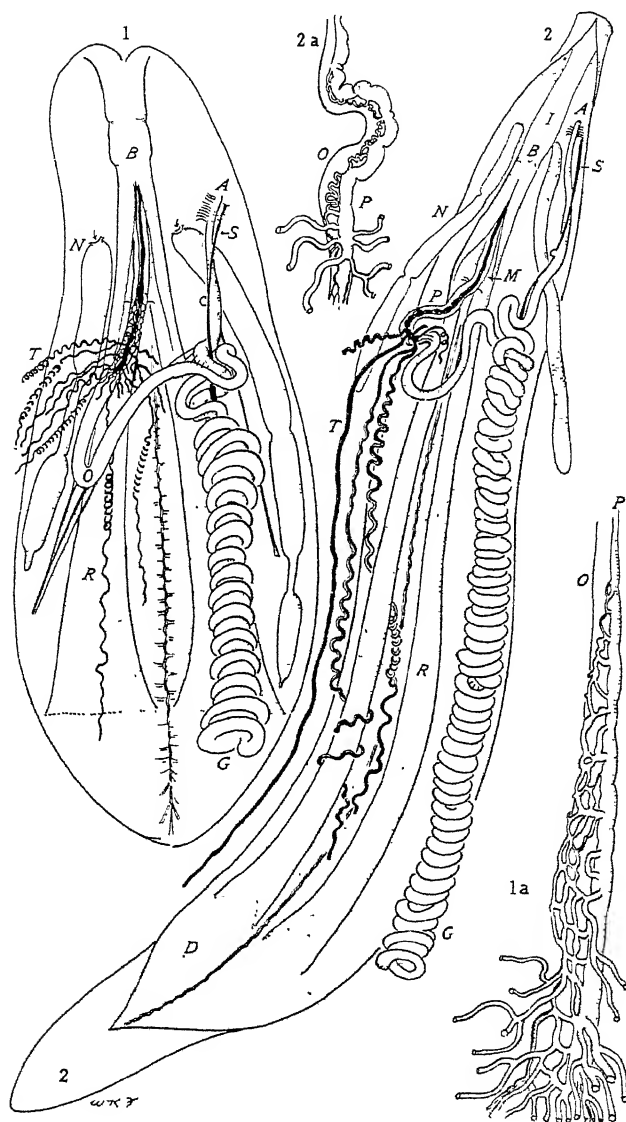
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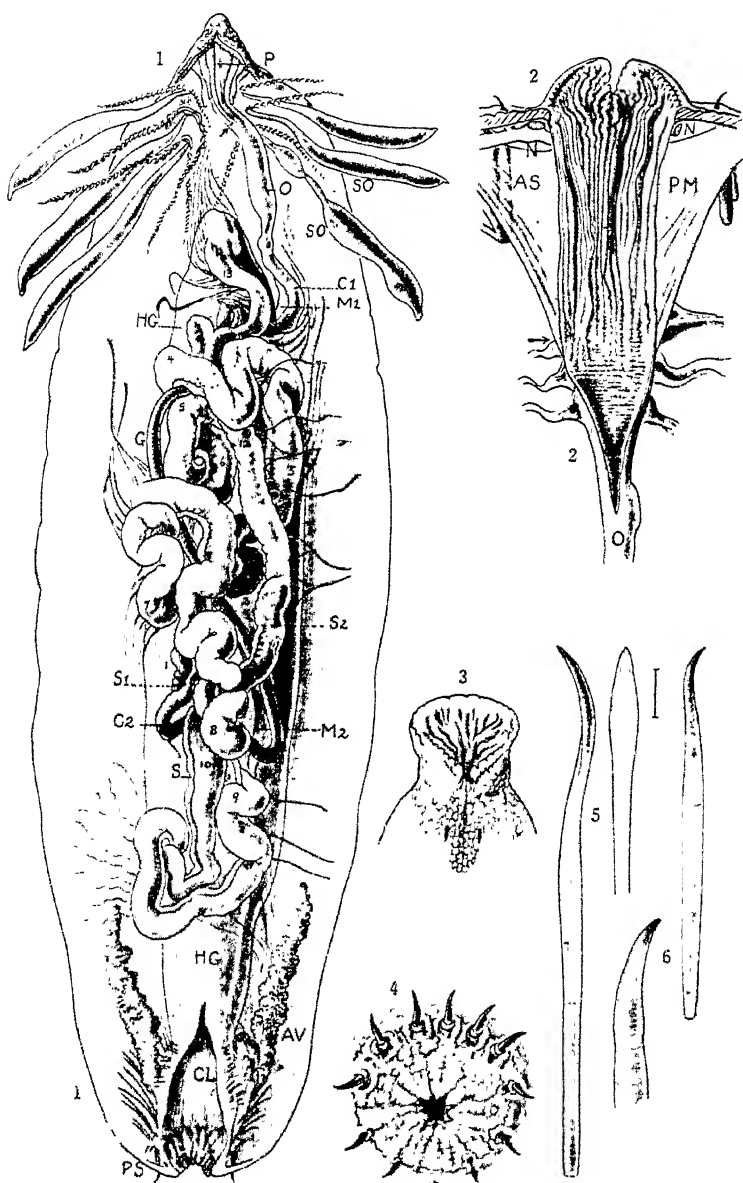
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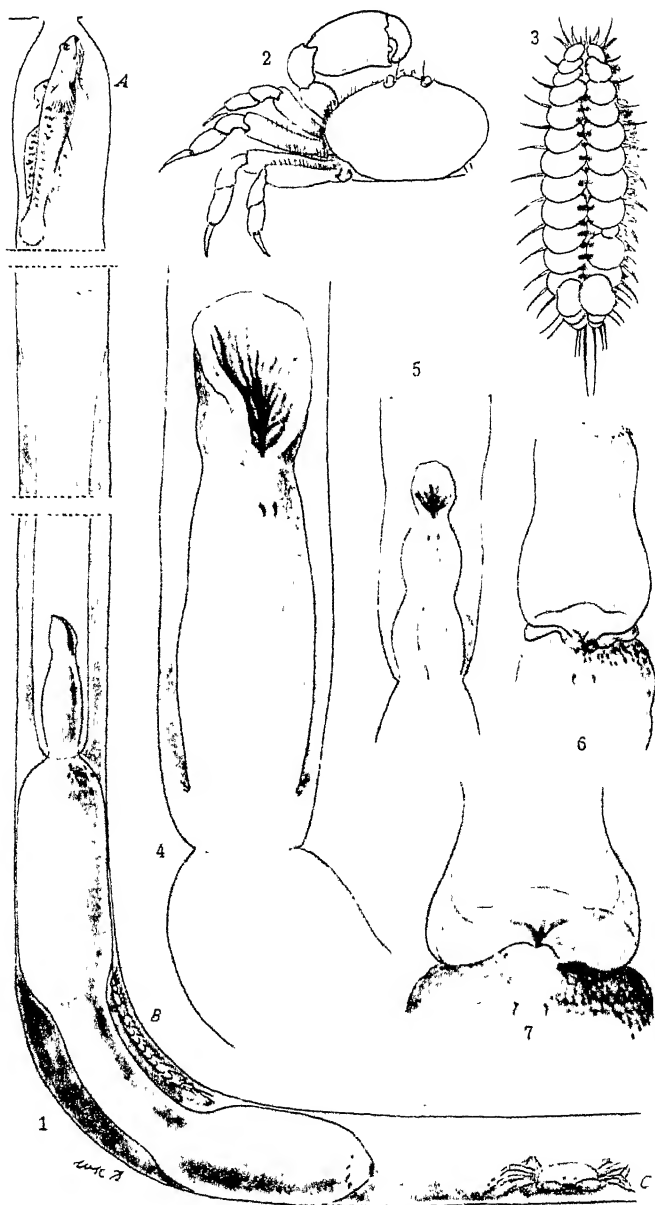
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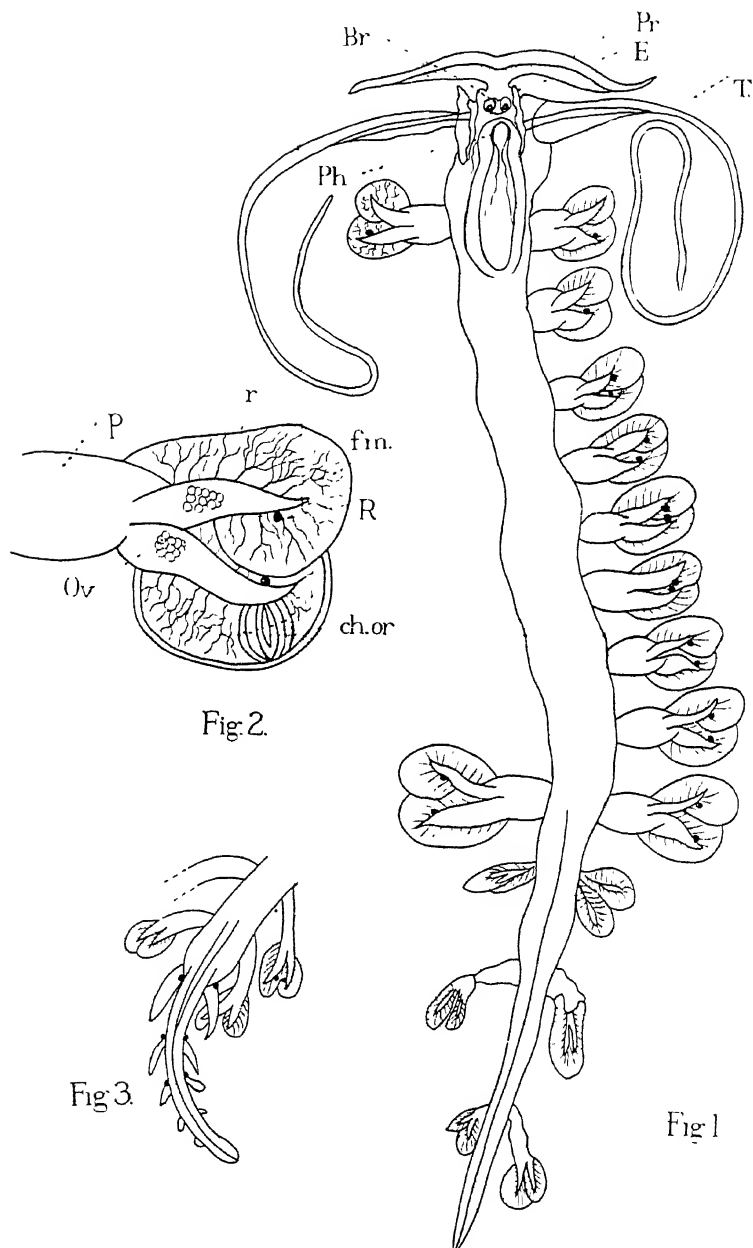
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A NEW ECHIUROID WORM FROM CALIFORNIA



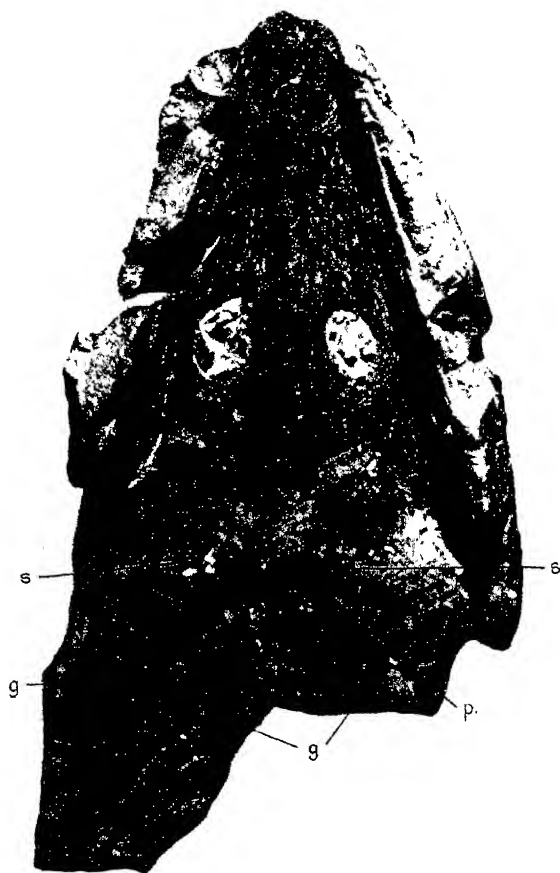
URECHIS CAUPO AND COMMENSALS.



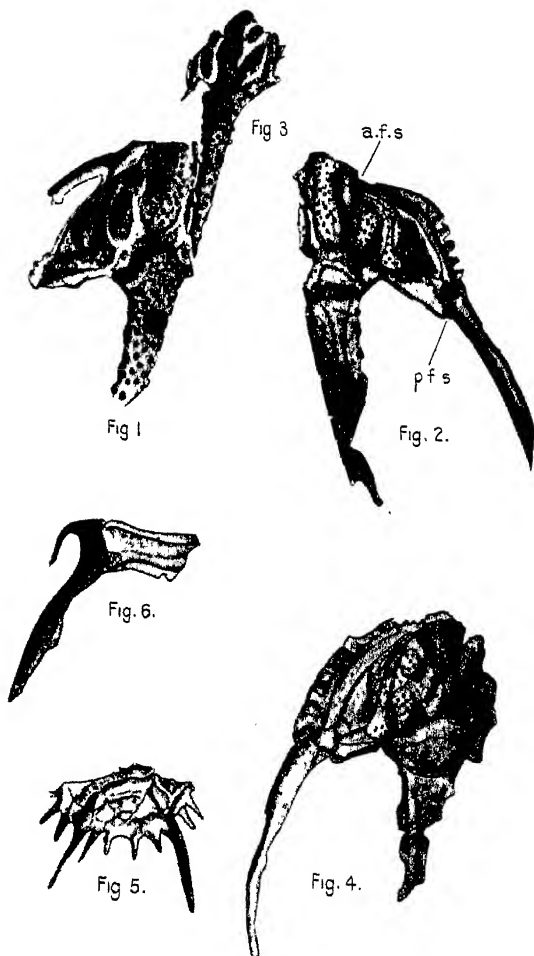
Johnstonella catharina, Gosse.



MICROMELERPETON CREDNERI, B. & W.

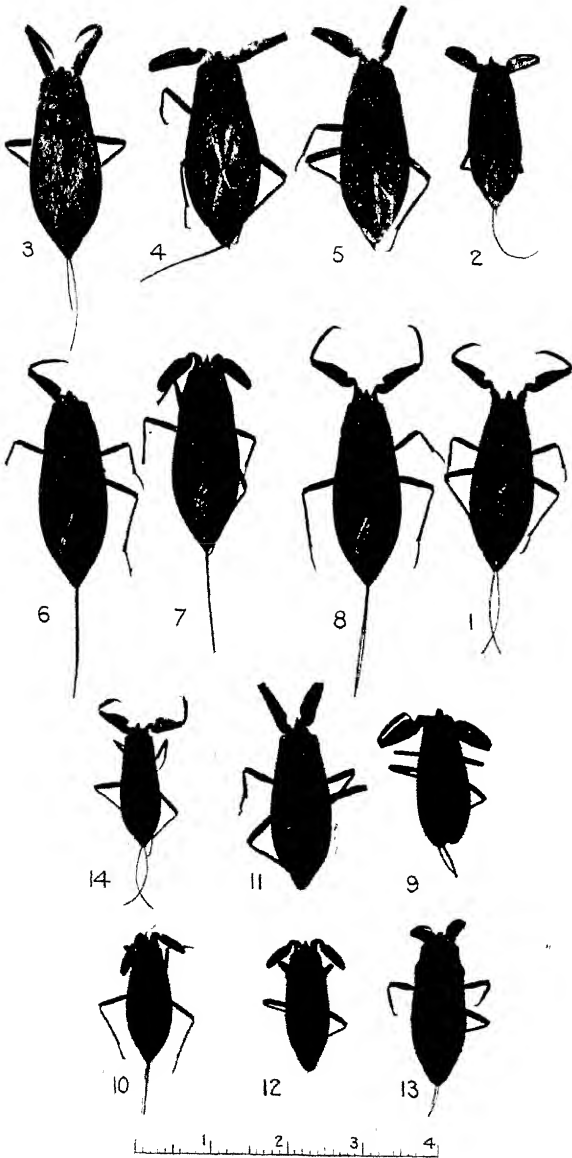


ARCHEGOSAURUS DECHENI, GOLDFUSS.



C.J.S del.

Figs. 1-4. *ACIDASPIIS MAGNOSPINA* sp. nov.
 Figs. 5-6. *ACIDASPIIS* ? *MAGNOSPINA*
 All figures, x 2½.



Species of *Nepa*.

FIG. 1.

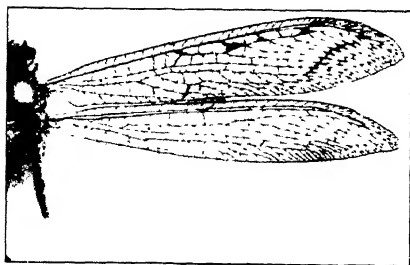


FIG. 2.

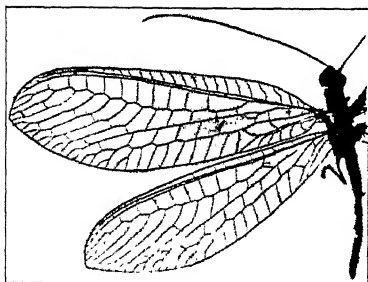


FIG. 3.

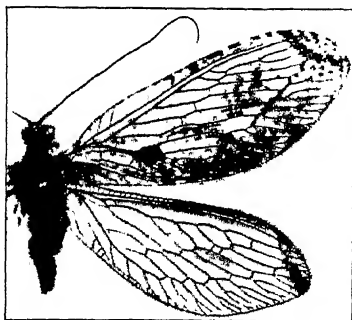
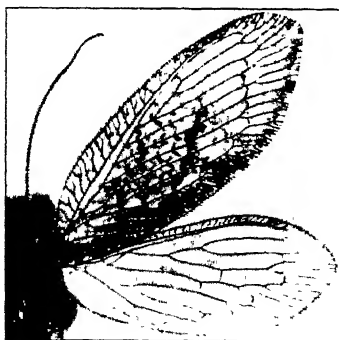


FIG. 4.



Abyssinian Neuroptera.



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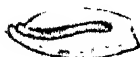
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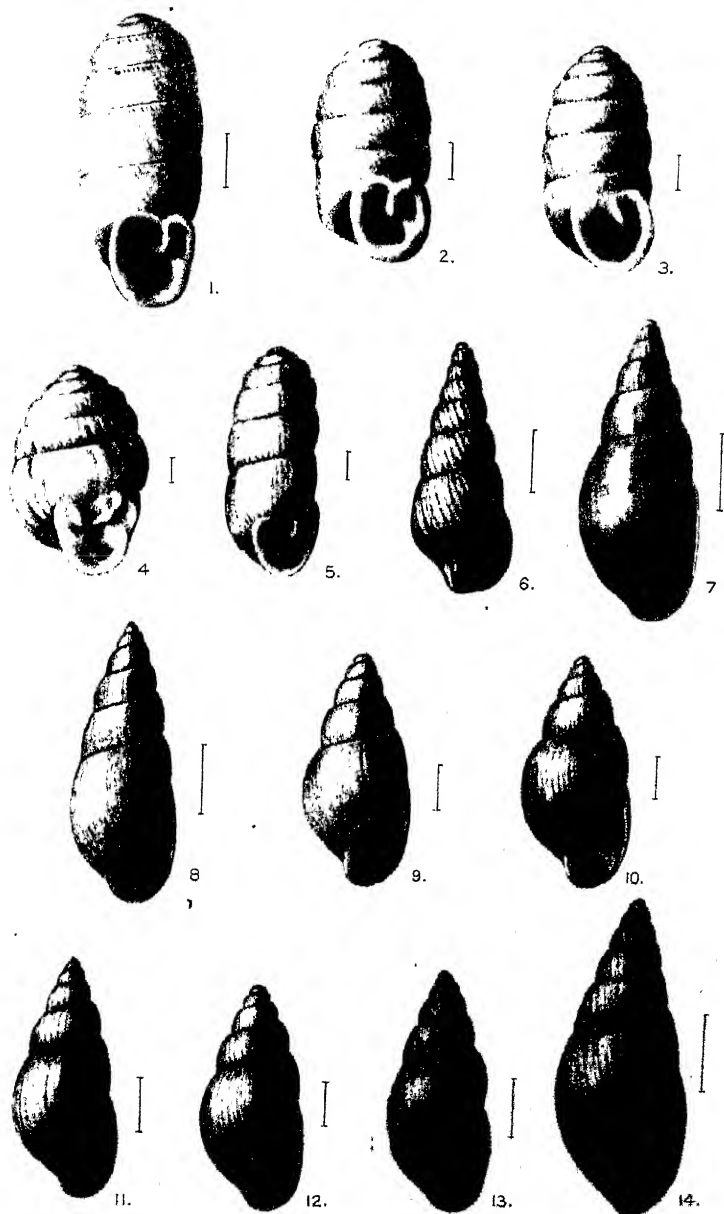


21

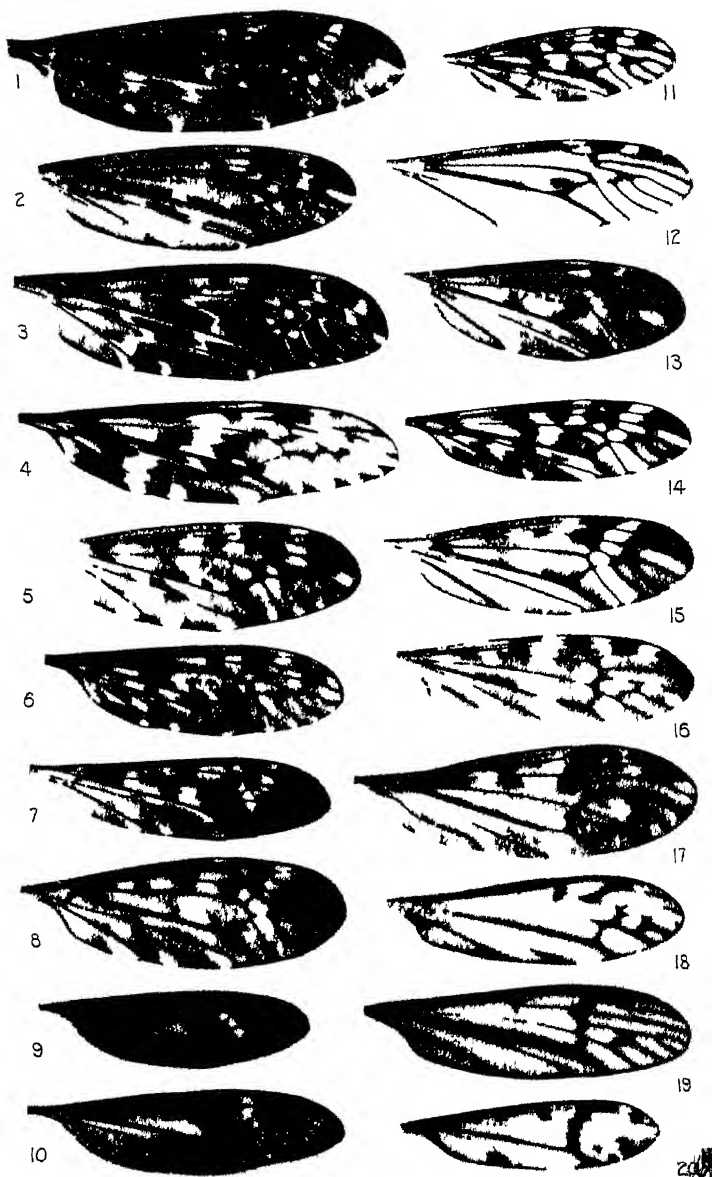
G Allan Frost, del

4

5

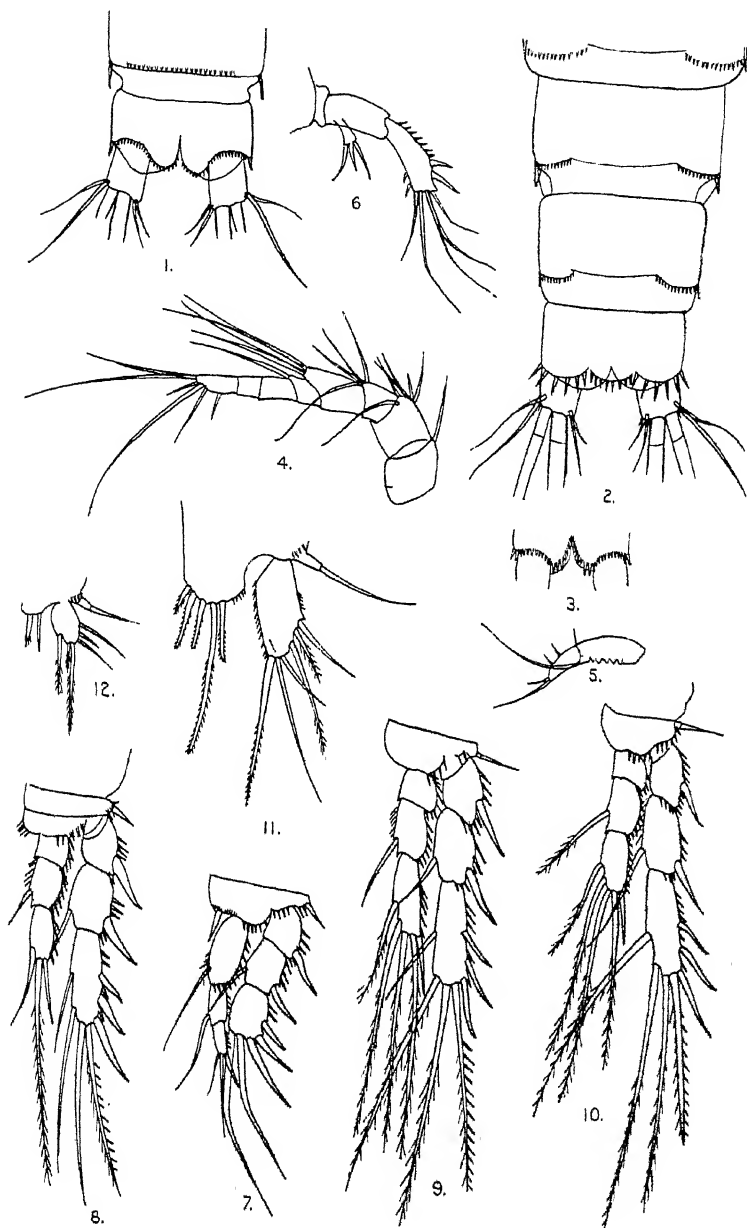


G. M. Woodward, del.



FW Edwards photo.

TIPULIDÆ from YUNNAN and TIBET

NITOCRA LACUSTRIS, SCHMANKEVITCH.

